the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JUNE 27, 1960

Prorating states eye Texas

. . . as biggest oil state grapples with problem of allowables for secondary-recovery projects.

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Humble gets foot in California's door

Nation's top marketing area may lure still another major marketer as Gulf knocks at door.

p. 80

A well analyst surveys his field

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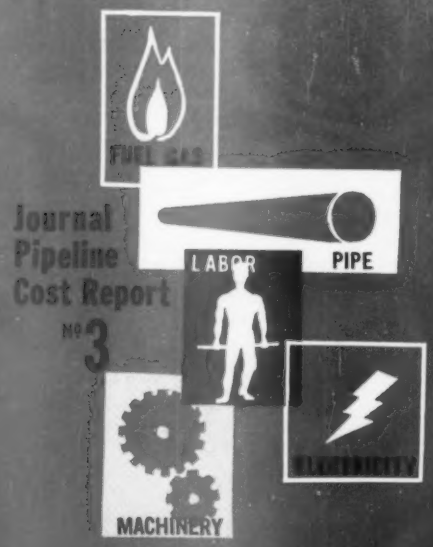

WHAT IT COSTS TO BUILD AND OPERATE GAS PIPELINES

• A special Journal report p. 99

ROCKWELL "1600" *Aluminum* GAS METER

100 PSI WORKING PRESSURE

Easy on the thighs

HOW TO MAKE LIGHT WORK OF FIELD MEASUREMENT JOBS

For convenience, durability and ease of handling in the field, there's nothing to compare with the Rockwell "1600." This meter weighs only 63 lbs, so is easy to carry onto location and install. Weathering is no problem to the sturdy outer aluminum case: neither are the bumps and knocks encountered in field service. With it you get a generous capacity rating of 1600 cfh at 4 oz inlet pressure. You can increase this rating materially by measuring gas at higher pressures—up to 100 psi.

ROCKWELL "1600" METER WITH EMCORECTOR

The "mechanical brain" atop this "1600" meter is an Emcorector gauge. The Emcorector accurately converts gas volumes measured at high variable pressures to any corrected base pressure for billing purposes. For full details, write Rockwell Manufacturing Company, Dept. 43-F, 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada, Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

ALUMINUM GAS METERS

another fine product by

ROCKWELL

OIL AND GAS JOURNAL
Vol. 58, No. 26

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SPECIAL PIPELINE REPORT

What It Costs to Build and Operate Gas Pipelines 99-114

By Gene Kinney

Station Costs Vary by Company and Type of Drive **100**

Time and type of machinery have a tremendous effect on how much it costs to build and operate compressor stations on a gas-transmission line. Older systems are characterized by lower investment and higher operating costs. The converse is true for newer systems.

Centrifugal Stations Lower Costs for Fiscal 1960 ..... **102**

Total installed centrifugal horsepower exceeded reciprocating horsepower by a wide margin during fiscal 1960. Average industry investment costs are lower than 1959 because of this trend.

What It Costs to Build a Pipeline **106**

It takes more money each year to install the same amount of pipeline. Right-of-way comes dearer and tougher each year, and materials inflation is a regular thing. Contract prices appear to be the most stable cost factor.

What to Expect in 1960-61 Construction Costs **110**

Here are selected examples which show a wide range of diameters and varied terrain. Projects have been recently approved or are still pending before FPC.

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Using Control Computers for Petroleum Processing **116**

By James W. Lane and R. Curtis Johnson

Studies of on-line digital computers show possible substantial operating and economic benefits when applied to crude distillation, catalytic cracking, catalytic reforming, butane isomerization, alkylation, polymerization, and solvent extraction.

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How to Handle Catalyst **130**

Finding Multiphase-Flow Answers **133**

By H. C. Bozeman

Joint AGA-API committee is pooling data and resources to determine multiphase pressure drops in all sizes of pipe, installed in various positions.

Drilling—Production

Section Mill Can Save Money **120**

By Clarence Leathers

The modern section mill has cut cost of several types of well rework jobs by at least 25%.

How to Insure Against Blowouts **123**

By T. B. O'Brien and W. C. Goins, Jr.

Part 2 of three parts. This installment is devoted to development of a method for killing blowouts.

The Role of Economics in Reserve Valuations **126**

By E. A. Hartsook

Part 2 of two parts. Price, payout, and interest rate are of tremendous significance in valuation calculations.

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By Joseph Zaba

A look at the pumping motion.

Pipelining

Finding Multiphase-Flow Answers **133**

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Pipeline Construction Report **137**

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
June 27, 1960

Refiners have been trying to hang themselves, but consumers cut the rope.

Runs jumped 198,000 bbl. daily to a total of 8,034,000 during the week ended June 17. Even with this high flow of crude, stocks of four major products decreased 1,061,000 bbl.

The improved stock position was due to increases in demand which were strong enough to make a stock correction the refiners seemed to be fighting.

Here's how the demand pendulum swung:

...Gasoline averaged 4,800,000 bbl. daily, the highest this year.

...Kerosine demand was about 223,000 bbl. daily, well above the May average.

...Distillate averaged near 1,500,000 bbl., the highest since about the middle of April.

...Residual demand was about normal for this time of year. (For more figures see p. 214.)

▼ ▼ ▼

Completions are off 15% in Canada.

So far this year completions total 958. This compares with 1,134 for the same period of 1959. In the U. S. the cumulative total for the year is 19,674—down 3,260 from the same time last year.

The labor beat:

OCAW's policy committee meets this week to set bargaining goals for the union's oil industry members. Regional meetings have already been held. Two major issues at these sessions: Proposed union management of company welfare plans, and companies' increasing use of contract labor.

Western Petroleum Refiners were told recently that contracting of work is a growing issue. Rev. Leo C. Brown said 40% of all arbitration cases involve this question (p. 79)*.

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

Look for a drilling flurry in Southeast New Mexico.

A Yates sand oil discovery has been made in Lea County by Hudson & Hudson. The well in West Tonto area at 1-18 Federal flowed 648 bbl. of oil daily from perforations at 3,259-3,263 ft. This is the first Yates oil in the area and one of the most important strikes in Southeast New Mexico this year.

Another big discovery in Lea County, Ohio Oil Co.'s 1 Lea Unit Federal, is testing a fifth possible pay zone. The 15,000-ft. wildcat found shows in the Devonian after getting shows previously in the Delaware, Bone Spring, Upper and Lower Bend.

Northwest Lisbon looks like a giant. It's a little early to be sure, but it may be the third big field in Utah's Paradox basin (p. 185).

Costs are up; income is down on gas-transmission lines.

Operating expenses were 65% of revenues in 1958, an increase of 8% over 1949. In the same period income declined from 16.5% of revenues to 10.4%.

A brighter note: An abnormal number of centrifugal station installations are lowering average industry investment costs for fiscal 1960. (A special report on transmission line costs starts on p. 99.)

Alberta-to-California gas line may not start this year.

Pacific Gas & Electric, promoters of the line had planned to start construction this summer. Canadian approval has been obtained, but FPC and California approval isn't likely before August. Clearing of right-of-way could be started—pipe laying may have to wait until 1961.

Percentage depletion withstands another attack but...

Opponents of the measure in the U. S. Senate marshalled 36 votes last week on a proposal to reduce the provision on a graduated scale. This is the highest number of senators that have ever voted against depletion (p. 86).

In Houston, Vice President Nixon said he would get more votes across the nation if he opposed percentage depletion and natural gas legislation (p. 88).

Gasoline's super market—California—is talking about:

Gulf Oil's plans to take over operation of Wilshire Oil, the state's biggest independent marketer and refiner. Gulf has controlled Wilshire through a holding company. An announcement officially recognizing Wilshire as a subsidiary is expected soon.

Humble's initial move into the hurly burly market and the possibility of the company gaining strength through the acquisition of either Time Oil or Monterey (p. 80).

The ruling on trading stamps by the attorney general

which makes it illegal to distribute them after July 1, unless the cash value is posted at the pump. The ruling was prompted by the decision that stamps are a discount and subject to the state's price-language laws.

▼ ▼ ▼

Some cracks in the crude picture:

Texas Commission considers secondary-recovery proration.
The industry is anxiously awaiting the commission's answers to two questions:
Can secondary-recovery projects be prorated?
Are they getting more than their share of the pinched crude market?
The three men in Austin are now poring over a mountain of technical testimony. The big problem: Strike a balance so the incentive for secondary projects will not discourage further exploration (p. 73).

Eight-day production schedule continues for third month.
Texas oil wells will stick to the low schedule in July. It will mean a cut of about 46,907 bbl. daily from the June production level (p. 76).

The Kansas Corporation Commission is expecting a series of legal attacks stemming from its shutdown of fields where Derby Refining posted a price cut.
In Oklahoma the Corporation Commission is considering a raft of suggestions for paring the state's output to purchasers' requirements (p. 82).

▼ ▼ ▼

The Russians expand a crude line to satellites.
The big-inch line from the Second Baku area to four Soviet-controlled countries in eastern Europe is shaping up as one of the biggest pipeline projects in the world today. Under revised plans it will move crude for 2,800 miles. It is expected to deliver 300,000 bbl. daily by 1965 (p. 94).

Polyethylene demand booms in Japan.
The soaring market has prompted plans by two Japanese-American combines to construct plants which will each have capacities of 27,000 tons per year. Joined in the ventures are Mitsui Petrochemical and Du Pont; Nitto Chemical and Union Carbide (p. 95).

Highway guard posts of tough butyl rubber are being tested in the Midwest.
First reports say their shock absorption qualities are so great that vehicles moving at 60 m.p.h. can be brought to a stop by three rubber posts in a series with no serious damage to driver, car, or posts.

Market Memo

June 27, 1960

Summer arrived last week and so did Floyd Patterson, the latter with the type of knockdown punch that crude runs to stills need to balance supply with demand.

Until recently, top management has been a poor trainer.

Sellers are now sparring with buyers for higher prices. But their punch is weak.

Pre-July Fourth supply is both ample and excessive for any expected demand.

This conflict of buyer-seller interest will continue until after-holiday demand produces better trends and higher spot prices.

Late spring demand has passed. It is later than most refiners realize.

Gulf Coast prices are stalemated, awaiting better demand.

Gasoline for spot lifting from the Gulf is priced at one quarter to three-eighths cent off posted prices.

Number two is holding close to the eight cents posted price, spotwise.

Number six fuel, bunker C and low sulphur at respective postings of two dollars ten cents and two dollars forty-five cents per barrel is in a low supply position due to reduced residual import quotas. Mississippi River markets are firm on gasoline, with occasional hints that historic sellers may become spot buyers before summer ends. Mid-river gasoline prices range from low Gulf Coast of ten and three quarters cents up to eleven and one quarter cents for 92 RON.

Burning oils from mid-river points are currently inactive.

Group three northern shipment gasoline is firm at posted price of eleven and one half cents for 91 RON. Volume buyers get the usual discount of one quarter cent per gallon, but price cutting has not been popular since the start of June.

Middle distillates out of group three for northern shipment displaced contra-seasonal strength with an increase in posted prices of one-quarter cent per gallon on June 21.

Number two posted price advanced from seven and three-quarters cents to eight cents per gallon. Refiners are not pushing sales at the new price basis, which is three-quarters cent below posted price this time last year.

In Chicago, 91 RON gasoline is posted at 12 cents and demand now stands a good chance to advance this price basis.

Number one, posted at nine and one-quarter cents in Chicago, is dormant. Number two, posted at eight and one-half cents, is being offered at discounts of one-quarter cent.

YOU'LL GET WATCH MAKER'S PRECISION WHEN YOUR "SPECS" READ HYATT

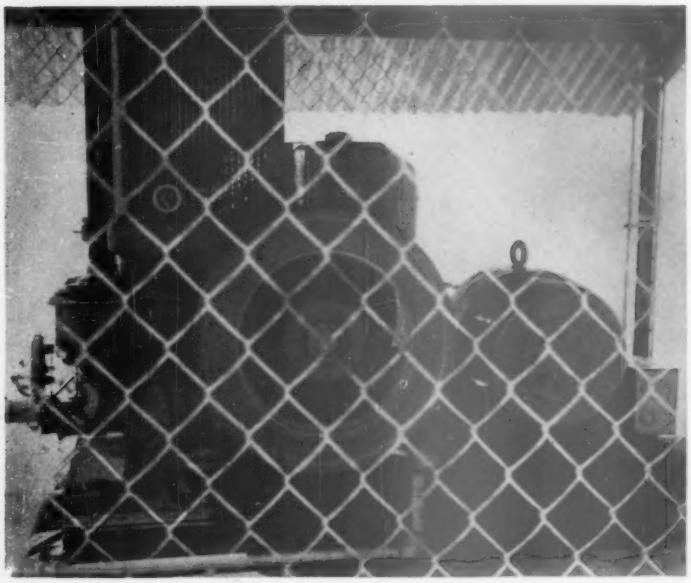
Holding roller diameter variation to 50 millionths of an inch is neither impossible nor impractical for Hyatt. With the help of automated precision equipment, we do it every day. For it takes precise and exacting care to build unsurpassed reliability into a Hyatt Hy-Roll bearing. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

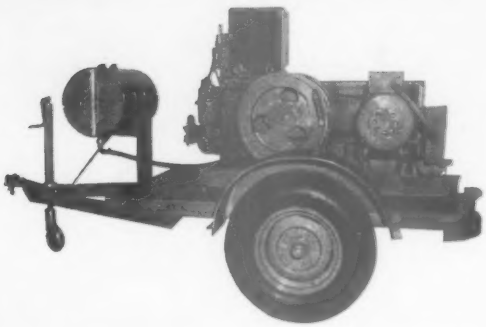
Replacement bearings available through United Motors System and its authorized bearing distributors.

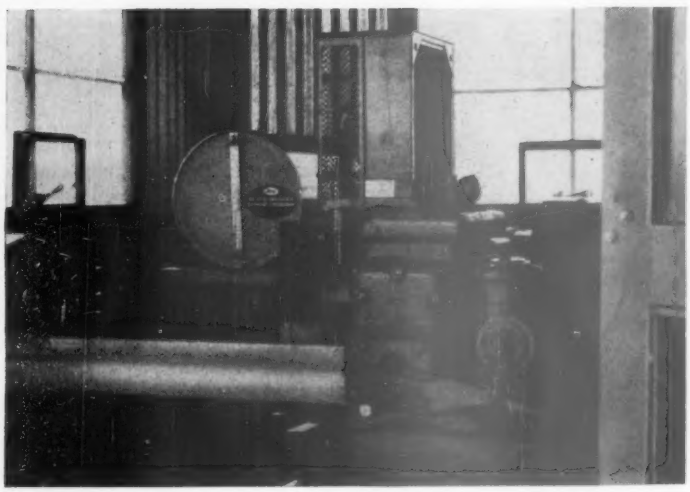
HYATT HY-ROLL BEARINGS

IN ROLLER BEARINGS HYATT IS THE WORD FOR GM RELIABILITY

Why Witte 98RBD Cathodic Protection Engine-Generator Units stop pipe line corrosion loss







A corroded pipe line cannot be restored but you can prevent corrosion from starting, or once started, prevent further corrosion with cathodic protection. That's why one of the world's largest pipe line companies selected Witte 98RBD Engine-Generator Units for their system. They chose Witte because only Witte units provide:

1. Dependability... they operate continuously with minimum attention.
2. Versatility . . . units have a 32-40-volt, 3KW generator in a wide speed range from 750 to 1800 rpm.
3. Long-Run Service . . . units are equipped with oil make-up reservoir and float valve as well as lube oil and cooling water safety controls.
4. Condenser Cooling . . . a constant temperature is automatically maintained under any operating condition.
5. Balanced Design . . . counterbalanced crankshaft assures smooth running and long life.
6. Choice of Installations . . . the 98RBD operates as efficiently when running in the open, under all-weather conditions, as it does in weather-protected houses. Trailer-mounted units are also available where portability is a requirement.

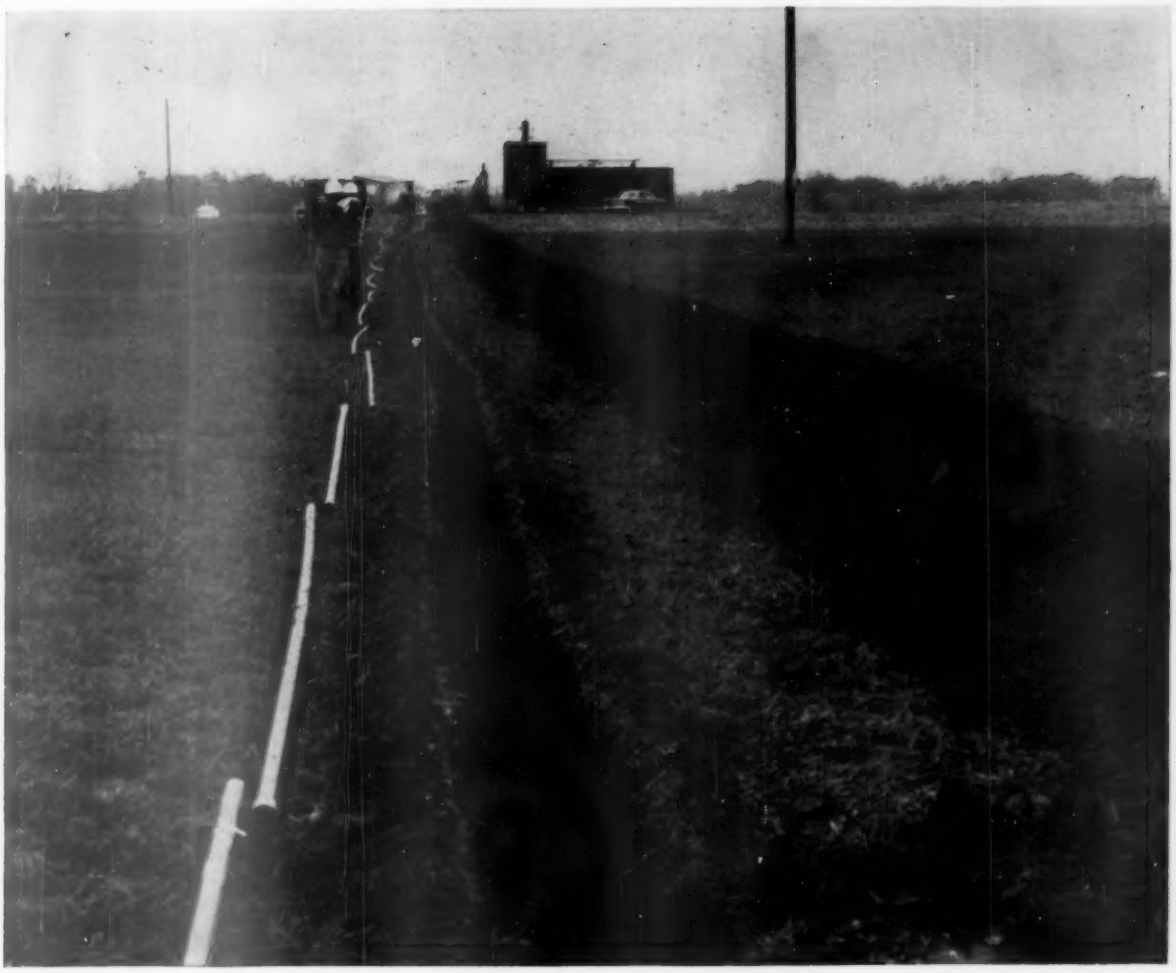
Get complete information on Witte units at any oilfield supply store.

USS and Witte are registered trademarks

Witte Engine Works
Oil Well Supply
Division of
United States Steel

USS

Offices and Plants: Kansas City 26, Missouri



Pipe the easy way to lay salt water disposal lines

Koroseal PVC pipe cuts installation time in half, won't corrode, can't rust or rot, doesn't clog up

INSTALLING a Koroseal pipeline is remarkably easy. It's so light two men can carry 10 lengths of it without strain. It can be laid in half the time it takes to lay steel pipe. And Koroseal can be joined with labor-saving solvent-cementing that will not work with other pipe.

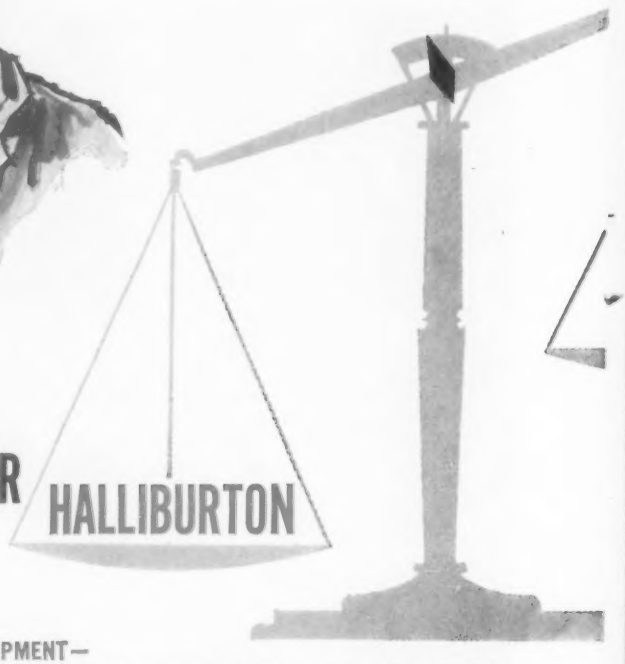
But what makes Koroseal PVC pipe particularly ideal for salt water disposal lines is its ability to resist just about everything that ruins other pipe—corrosion, salt water, chemicals and sour crude oil. It will not rust or deteriorate underground, even in the most severe acid or alkali soils.

Koroseal's mirror-smooth interior finish virtually eliminates the buildup of salt and paraffin that clogs other systems. Because of the smooth interior, a 1½″ Koroseal pipeline handles the same quantity as a 2″ steel pipe. At the oil field pictured above, the 3390-foot Koroseal disposal line will handle 4200 gallons of salt water a day.

With all these advantages, Koroseal is equally good for crude oil gathering lines, gas lines, transmission lines and many other oil field applications. If you have a problem you think Koroseal might solve, write the *B.F.Goodrich Industrial Products Co., Dept. M-859, Akron 18, Ohio.*

Koroseal—T.M. Reg. U.S. Pat. Off.

Koroseal rigid PVC products by B.F.Goodrich



IN ACIDIZING . . . THE FACTS FAVOR HALLIBURTON

When the need for improving the production rate of your well points to *acidizing*, your next step – selecting the service company – can be the key to a successful job. Here are some of the important factors that make Halliburton your *best choice* for the job:

PEOPLE –
The greatest single asset a company can offer its customers! The people who make up the Halliburton team provide your first list of benefits – training, skill, ability . . . and experience!

MATERIALS –
In selecting the chemicals to put into your acidizing job, you get the benefit of Halliburton's ability to choose the *best* materials from chemical manufacturers all over the world . . . not just a single source.

EQUIPMENT –
Engineered *from the start* by Halliburton designers specifically for oilfield service . . . built by Halliburton craftsmen . . . operated and maintained by experienced Halliburton field crews.

FACILITIES –
Strategically located throughout the free world . . . backed by the most extensive research and chemical laboratories of *any* oilfield service organization.

Specify Halliburton for your next acidizing project . . . and get the benefits of a completely coordinated service organization geared to do the job – large or small – with speed, efficiency . . . and at reasonable cost. See your nearby Halliburton Representative.

REGULAR ACID *The Principal Ingredient*

Halliburton Regular Acid, a mixture of Hydrochloric Acid and inhibitor, is the basic ingredient in many of Halliburton's chemical treating solutions for production improvement. Where applicable, HCl acid is the most economical approach as an aid for improving permeability in calcareous formations. It is also used as a conditioning agent prior to other types of well treatments.

PENETRATING ACID *For Low Surface Tension*

Penetrating Acid contains a surface active agent which tends to lower breakdown pressures in dense formations by imparting better "wetting" properties. The solution is designed for easier return of spent acid which is often needed in low pressure formations.

NE ACID *To Help Prevent Acid/Oil Emulsions*

In many instances, native crudes contain traces of emulsion stabilizers. Blended agents for Halliburton NE Acid aid in preventing emulsification of the crude with acid or spent acid.

HV ACID *Delayed Action For Better Results*

With additives, acidizing solutions can be "tailored" as true acidgels or as acid-in-oil emulsions. Each has controlled, increased viscosities for chemical retardation resulting in deeper penetration of unreacted acid. Formation characteristics determine the selection of the treating solution.

Fe ACID *An Aid to Preventing Re-deposition of Solids*

Fe Acid is particularly suited for use in disposal and injection wells. Normally, an encrustation of solids, primarily iron compounds, plate out on the formation adjacent to the well bore – obstructing the permeability. This acid is designed to remove these solids and deter their re-precipitation within the formation.

ALC-5 ACID *Low Fluid Loss Additive For Acid*

This additive is an economical approach to obtaining a retarded effect in any type of Halliburton acid solution. A more lateral movement of acid during treatment can be obtained with the Acid Loss Control agent covering a greater drainage area.

HF ACID *A Mud Removal Solution*

This surfactant-carrying mixture of hydrochloric and hydrofluoric acids is a low surface tension solution designed for the removal of mud or other silicate deposits that are restricting permeability. It is used most often in siliceous formations.

GYP REMOVAL SOLUTION *An Acidizing Approach*

This two-stage treatment is designed to chemically remove gyp scale which is normally insoluble in acid. The first stage treatment converts the scale to a chemical compound which can be removed by the second stage . . . a conventional acidizing treatment.

YOUR NEARBY HALLIBURTON REPRESENTATIVE WILL BE GLAD TO GIVE YOU MORE INFORMATION. CALL HIM SOON!

HALLIBURTON CHEMICAL SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY DUNCAN, OKLAHOMA

275 SERVICE CENTERS . . . JUST MINUTES AWAY FROM YOUR WELL

BAD GOING...

A new 25-D Pullshovel cleaning out a rocky section on a gas line.

never stops a NORTHWEST!

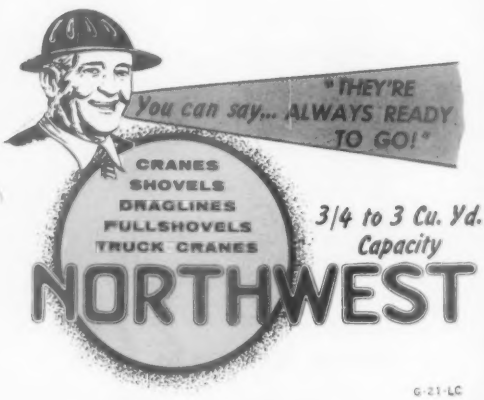
THE SCENE is along the Fraser River estuary near Vancouver, B. C. The job is a gas line for the B. C. Electric Company. The line runs through a peat bog. The bottom is eight feet down and water comes to within six inches of the surface for the area is practically at sea level. Over a mile of 24 inch pipe was floated into place from one central location. A veteran Northwest Model 25 owned by Cerro Construction Company of Vancouver swings 2½-ton weights into place to keep the pipe down. Here again is an illustration of the value of these workhorses of the pipe lines, the ¾ yd. Crawler rigs.

The Northwest 25-D travels across country like this with ease on mats, moving its own road ahead of it. It is always ready to go and serves equally well as a Dragline, Crane, Backfiller or Pullshovel. It has the weight, power and capacity to handle jobs that lighter machines of the same rating can't handle. As a Pullshovel, it has often demonstrated the digging force to remove plugs and handle hard, rocky going that trenchers and many other makes of pullshovels are often unable to cut through.

Smooth swing, made possible by Uniform Pressure Swing Clutches, combines with the Feather-Touch Clutch Control for accuracy and ease in handling pipe and weights. The Northwest Independent High Speed Worm Boom Hoist will take the punishment of hour after hour booming. Northwest Crawlers have been proved in miles of pipe line work and there are many other advantages that have made it the choice of pipe line contractors all over the continent. Ask for the full story on the 25-D.

NORTHWEST ENGINEERING COMPANY

1513 Field Building • 135 South La Salle Street • Chicago 3, Illinois



G-21-LC

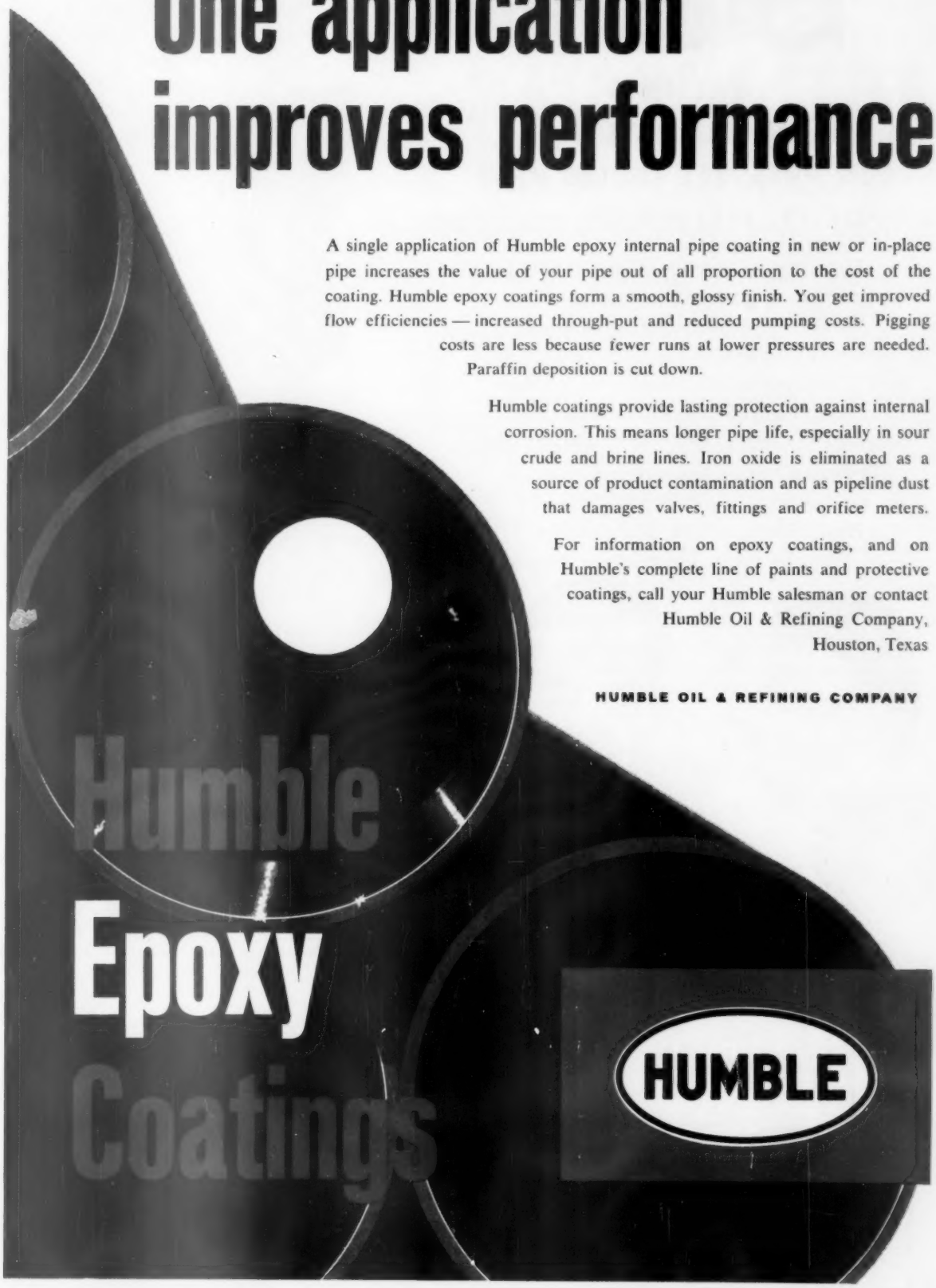
One application improves performance

A single application of Humble epoxy internal pipe coating in new or in-place pipe increases the value of your pipe out of all proportion to the cost of the coating. Humble epoxy coatings form a smooth, glossy finish. You get improved flow efficiencies — increased through-put and reduced pumping costs. Pigging costs are less because fewer runs at lower pressures are needed. Paraffin deposition is cut down.

Humble coatings provide lasting protection against internal corrosion. This means longer pipe life, especially in sour crude and brine lines. Iron oxide is eliminated as a source of product contamination and as pipeline dust that damages valves, fittings and orifice meters.

For information on epoxy coatings, and on Humble's complete line of paints and protective coatings, call your Humble salesman or contact Humble Oil & Refining Company, Houston, Texas

HUMBLE OIL & REFINING COMPANY



O·C·T

PRESENTS
THE ULTIMATE IN
LOW PRESSURE TUBING HEAD
SIMPLICITY, FLEXIBILITY, ECONOMY

Here it is . . . a low pressure tubing head that combines three all-important factors—*simplicity, flexibility* and *economy.* With this new unit you can use tubing stripper in combination with other equipment if desired, without the necessity for adding stripper housing or bowl. Threaded tubing hangers are available for use with or without the stripper. Ease of installation: It's a cinch! Ruggedness? It's tough as a boot!

When you need a low pressure head, you can get the best from

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SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

where progress is a daily practice

RIG-UP FASTER.. MAKE HOLE SAFER

with CONTINENTAL-EMSCO B-SERIES PORTABLE MASTS

FASTER — Continental-Emsco's B-Series Masts shorten rig-up time to a minimum. Exclusive rear leg pivot permits time-saving low-level assembly.. even with high substructure no ramps are needed. Mast sections and crown assembly quickly go together with simple pin connections.

Mast raises smoothly, safely in one continuous operation. There's no need for snubbing lines, since C-E's B-Series masts never go over center.. raising lines remain in tension at all times during raising or lowering. Masts can be moved in one piece or knocked down into easily portable sections.

SAFER— All load bearing base connections are at floor level and can be readily seen by the driller. Leveling, to correct substructure settlement, is quick and easy. Driller has a clear view to top of mast, since interior and skew bracing is kept to a minimum. C-E's mast design allows maximum block travel for faster, safer hoisting.

All C-E masts meet API specifications for hook load and substructure capacity. Wind load capacity is 75 mph with full setback of pipe.

Contact your local C-E representative for full details.
Continental-Emsco Masts are also available through leading supply stores.

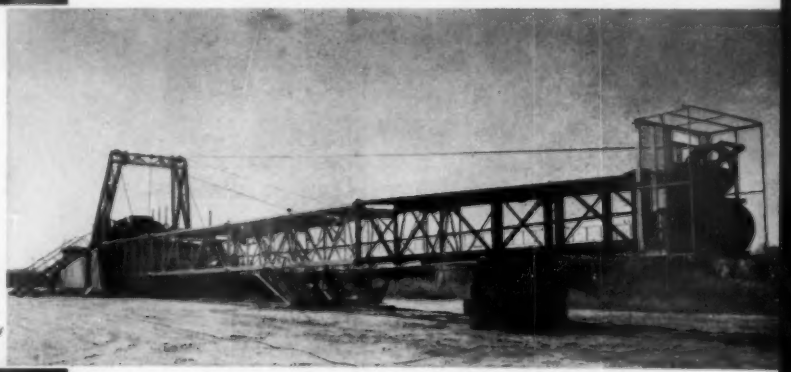
Choose your next mast from one of these..

B-127
Clear Height 127',
Nom. Gross Capacity
416,000 lbs.

B-133
Clear Height 133',
Nom. Gross Capacity
590,000 lbs.

B-134
Clear Height 134',
Nom. Gross Capacity
830,000 lbs.

B-142
Clear Height 142',
Nom. Gross Capacity
1,053,000 lbs.



For Service that Sings.. Equipment that Hums..Go..

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Serving the Oil and Gas Industries ... Worldwide

M902

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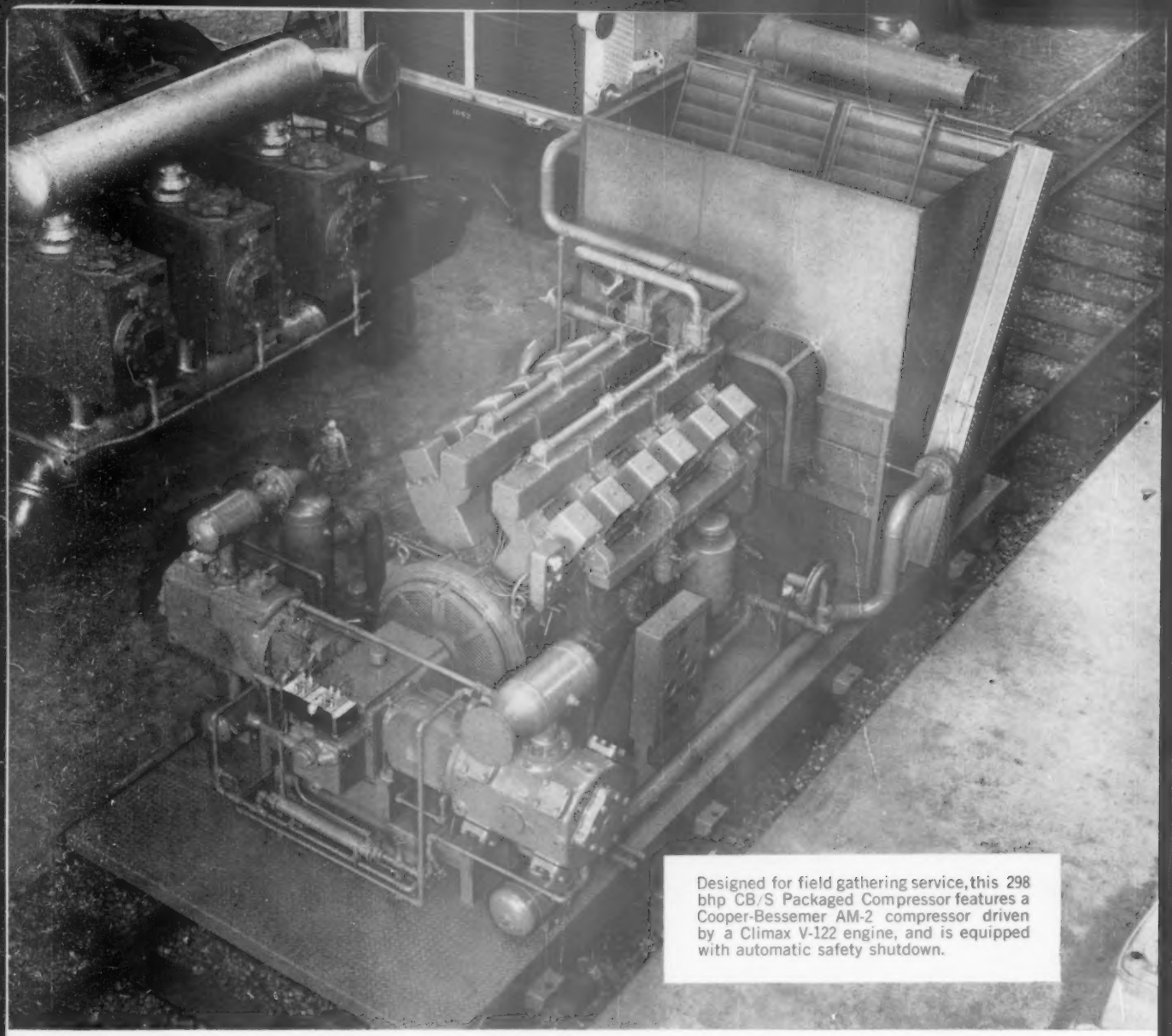

Designed for field gathering service, this 298 bhp CB/S Packaged Compressor features a Cooper-Bessemer AM-2 compressor driven by a Climax V-122 engine, and is equipped with automatic safety shutdown.

Building packaged compressors is our business . . . our only business. This single objective is the reason CB/S Packaged Compressors are more advanced in design . . . more efficient in the field.

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AGAIN AND AGAIN

REPEATING BUSINESS=LATEX

EFFICIENT — DEPENDABLE — QUALIFIED

Yes, repeating business and *LATEX* go hand in hand. For over one quarter century LATEX has been serving the oil and gas industry. Invite us for your next construction job.

In addition to pipe lines *LATEX* offers an experienced organization for STATION CONSTRUCTION AND ALLIED WORK.

REMEMBER, LATEX QUALITY BRINGS REPEAT BUSINESS "AGAIN AND AGAIN"

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New time multiplexing and remote and reduce line requirements for

Five new basic time multiplexing systems—and a new remote index setting feature—add to the overall versatility of *Dur-O-Pulse* . . . give you advantages available in no other telemetering system.

With Time Multiplexing Units—

- You can transmit up to 15 signals either in one or two directions over a single channel.
- You can add intermediate stations without adding any additional transmission lines.

With Remote Set Index—

- Easy to set—set the index, push a button and the rest is automatic: a pulse whose duration is directly proportional to the value of the set point is transmitted to remotely located controllers.
- Can be used as part of a multiplexing system.

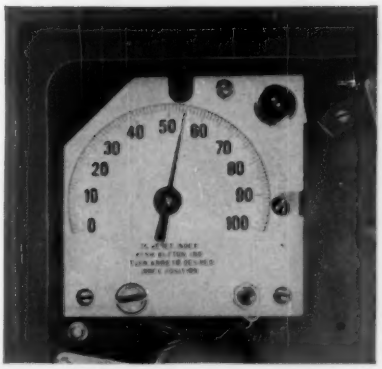
The *Dur-O-Pulse* system measures and transmits process variables such as pressure, temperature, flow, level, voltage, current, power and speed. It can send data quickly and accurately over all types of circuits.

set index setting simplify operation Dur-O-Pulse telemetering systems

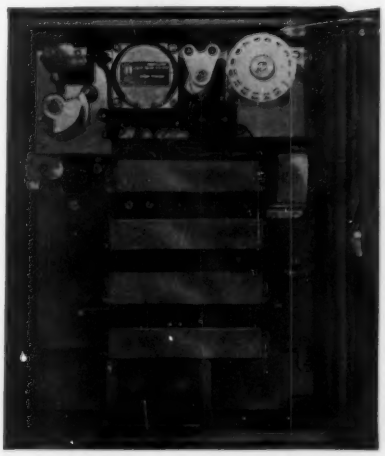
- Gives you set point indication at transmitting and receiving instruments.
- A single tone is required for the index signal when audio tone multiplexing is used.

Find out about *all* the performance and maintenance advantages of *Dur-O-Pulse* from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

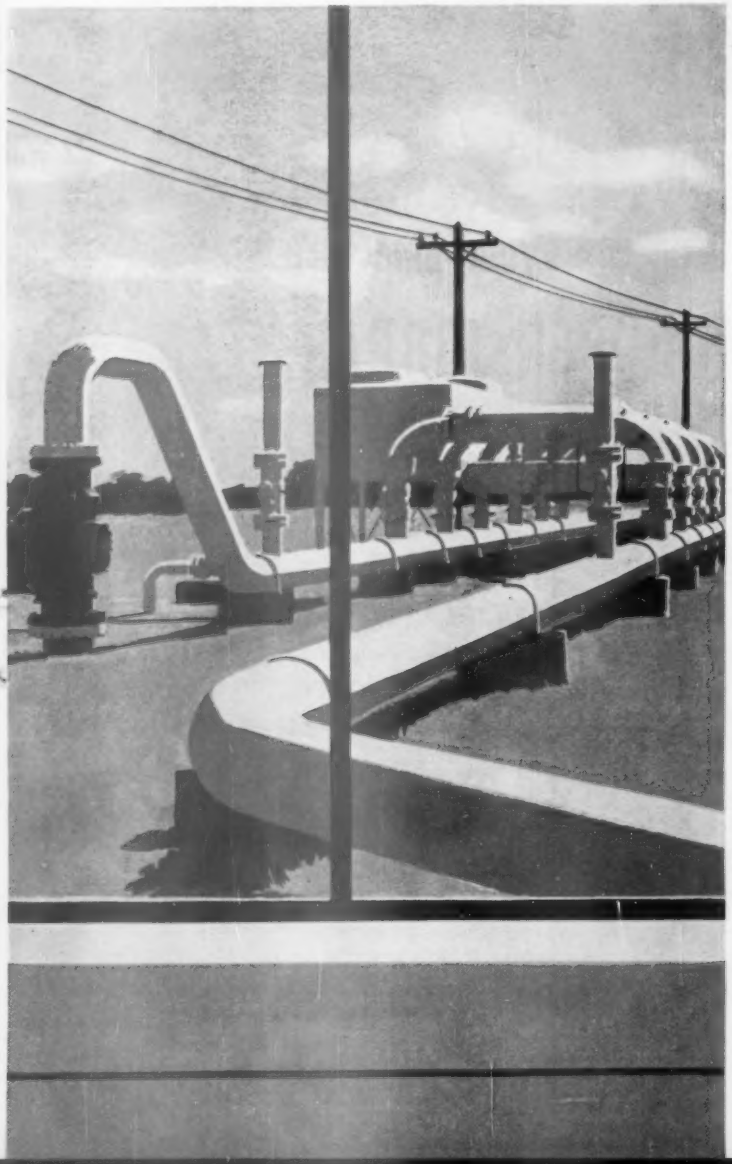
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.



REMOTE-SET INDEX TRANSMITTER eliminates separate push buttons or switches needed to drive controller index up or down scale. To readjust controller index it is necessary only to adjust the indicating pointer to the desired set point and push the start button.



TIME MULTIPLEXING UNITS transmit up to 15 variables in one or both directions and provide a synchronizing signal to keep transmitting and receiving units in step.



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PIONEERING THE FUTURE

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First in Control

SINCE 1885

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your pipe through the

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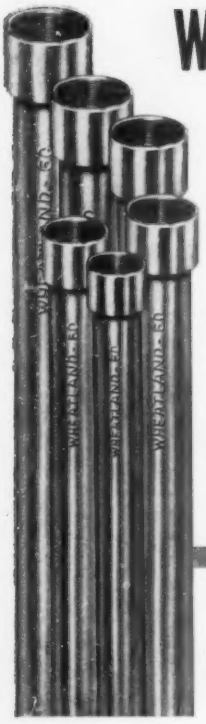

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MADE
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You can be sure this winning combination will supply you with steel pipe of unvarying high quality, job after job. And your Wheatland distributor sees to it that you get the pipe you need . . . on time!

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...pipe with the yearmark!

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MAGCOBAR
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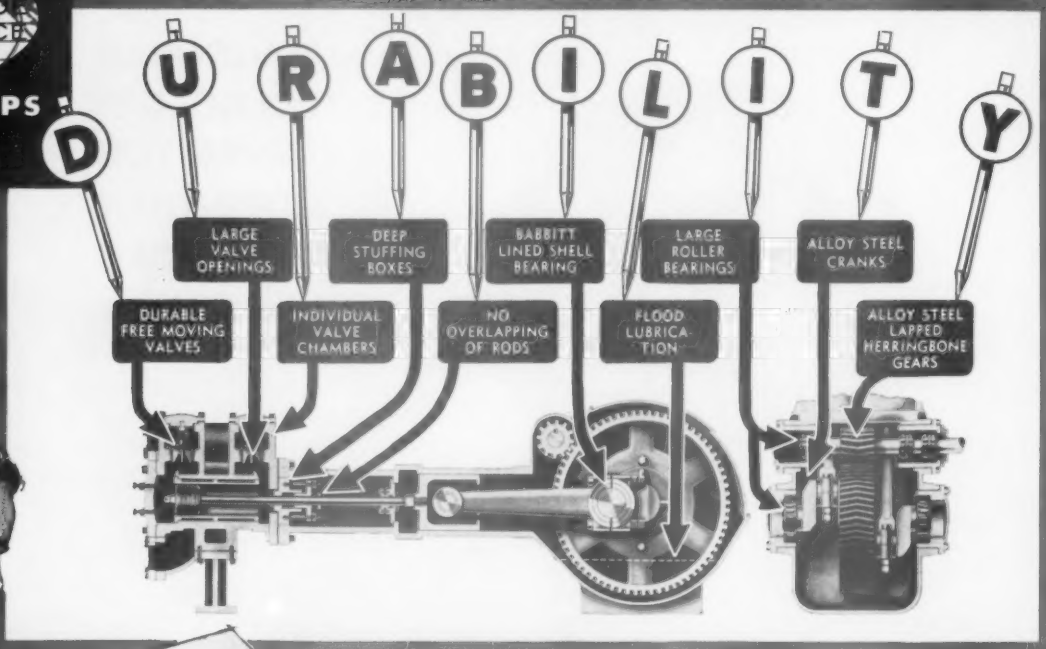
WORLD WIDE PREFERENCE

GASO PUMPS



NOTHING "ACCIDENTAL" ABOUT GASO PERFORMANCE

It's DESIGN that Explains Why Gaso Pumps Perform Better, Last Longer

There's no mystery about the extra years of trouble-free service you get from Gaso Pumps. It's all a matter of DESIGN.

Every detail of Gaso design is the development of 45 years' concentration on oil-industry pumping needs. Every part from main frame to gaskets reflects Gaso's continuous search for metallurgical and engineering advances which contribute to the goal of *maximum* performance and *minimum* upkeep, achieved with *fewer* parts made *extra-strong*.

In other words, it's the absence of weak spots in both design and components that explains the *bonus* of performance you get from Gaso Pumps.

GASO PUMPS
for every oil industry need

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FIRST and LANSING STS., TULSA, OKLAHOMA
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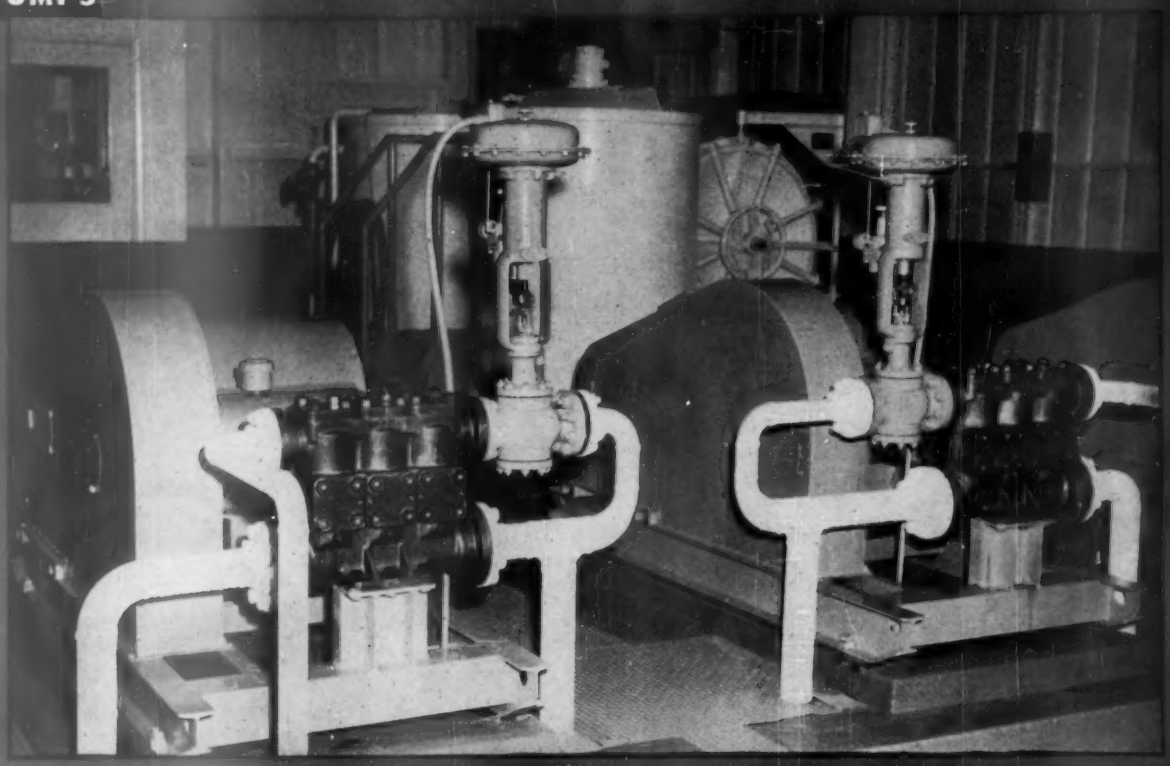
GASO PUMPS

WHAT'S BACK OF GASO LEADERSHIP IN

WATER FLOODING?



There's a Single-Word Answer: PERFORMANCE

The photograph shows one of a steadily mounting number of Gaso installations in water flooding service.

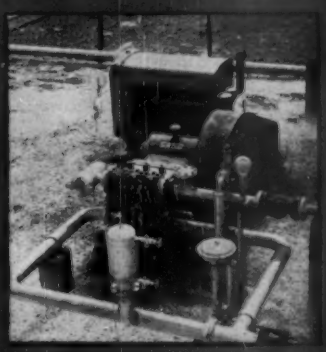
The injection pumps (3) are Fig. 3365, 1¾" x 3" Gaso Horizontal Triplex Plunger Pumps, driven by 40 HP 1200 RPM electric motors.

The fluid ends are of aluminum bronze fitted with ceramic plungers, non-adjustable type plunger packing (in both power and fluid ends) and Bakelite insert type valves mounted on Monel valve seats.

Each of the three pumps, operating at 350 RPM, delivers approximately 1075 barrels a day at 1500 pounds discharge pressure.

Complete adaptability to the job plus GASO design throughout is a time-tested guarantee of thoroughly dependable service extending far beyond the normal life expectancy of pumping equipment.

In the GASO line you will find the effective answer to any pumping problem associated with water flooding. Write for our 1960-61 catalog, or get in touch with our nearest distributor.



Gaso Pump in salt water disposal service in Louisiana

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for every oil industry need

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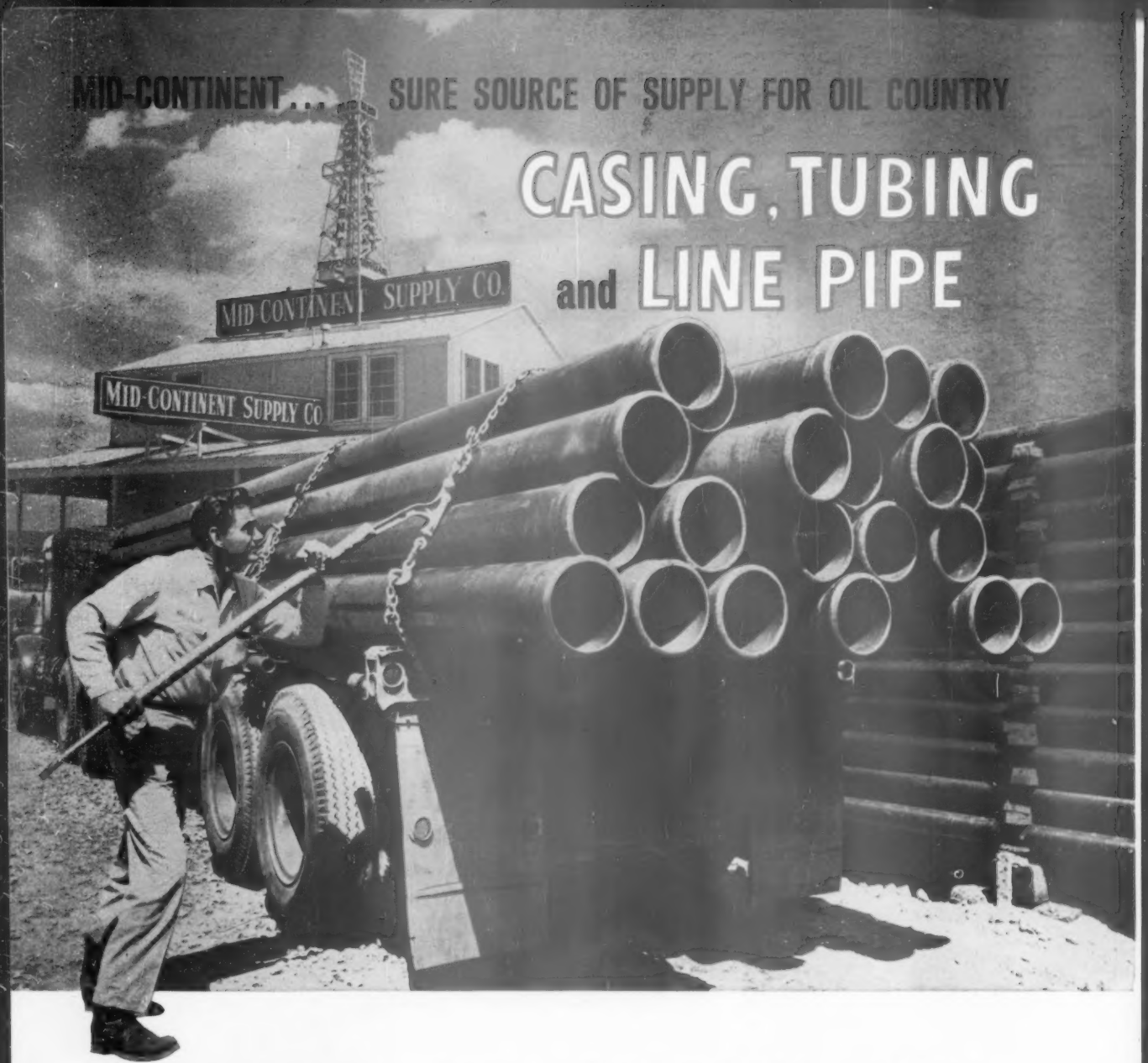
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Whenever or wherever you need casing, tubing or line pipe, count on your nearby "supermarket for the oil industry" to supply your exact needs promptly from large stocks of tubular items. High-strength casing and tubing are also available from Mid-Continent in a complete range of sizes, all quality-controlled in manufacture for uniformity, and for long and dependable service. Call your Mid-Continent representative today. Let him explain all the advantages of this sure source of supply — around the clock . . . around the world — for top-quality tubular goods.

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CHECK OIC FIRST...IT PAYS!

SERVICE to meet your valve needs is the "specialty of the house" at your nearby OIC Valve Distributor. As a first-line distributor, he gets OIC's all-out support to insure that you get the service you deserve. OIC's strategically located warehouses, and complete-line factory inventory "backstop" every OIC distributor with a multi-million dollar stock of bronze, iron, ductile iron, cast and forged steel valves. As a result of this strong distributor support, immediate delivery of the more popular items out of distributor's stock is common, and 4 to 5-day delivery out of warehouse or factory stock is routine. When quality is a problem, or delivery is urgent, phone your OIC distributor. Service is his business, and ours.

OIC VALVES | FORGED AND CAST STEEL, BRONZE, IRON AND DUCTILE IRON VALVES

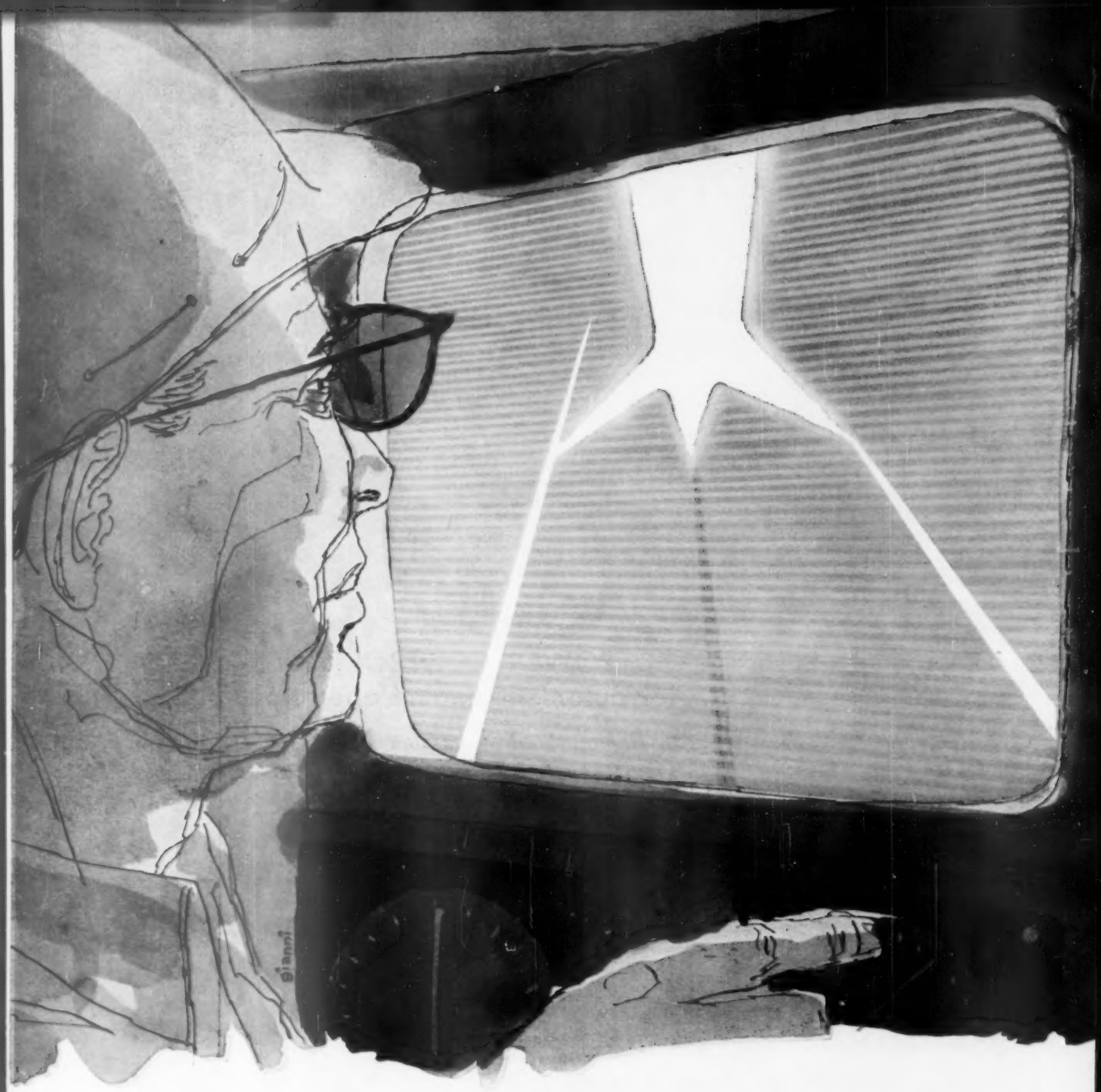
THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

Spying on a weld

A TV camera is the spy! Located inside that hulking section of USS National Electric Weld Line Pipe, it's a visual guide to accurate welding.

The operator welds by remote control. He uses push buttons to operate a welding head inside the pipe. Just in front of the welding head is a short-focus TV camera.

When the image flashes on the TV screen, the operator sees reference lines and uses them as a guide. This enables him to keep the electrodes for the inside weld centered on the seam of the formed plate. *In short:* the TV camera makes precise guiding of the welding possible.



The constant development and improvement of production techniques are just two of the reasons why National Tube is not only the largest but also the most experienced manufacturer of tubular products in the world. For more information on USS National Line Pipe, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania. Ask for bulletin #23.

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- AUTOMATIC START-STOP PANELS
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WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. / **New York • Tulsa • Los Angeles**
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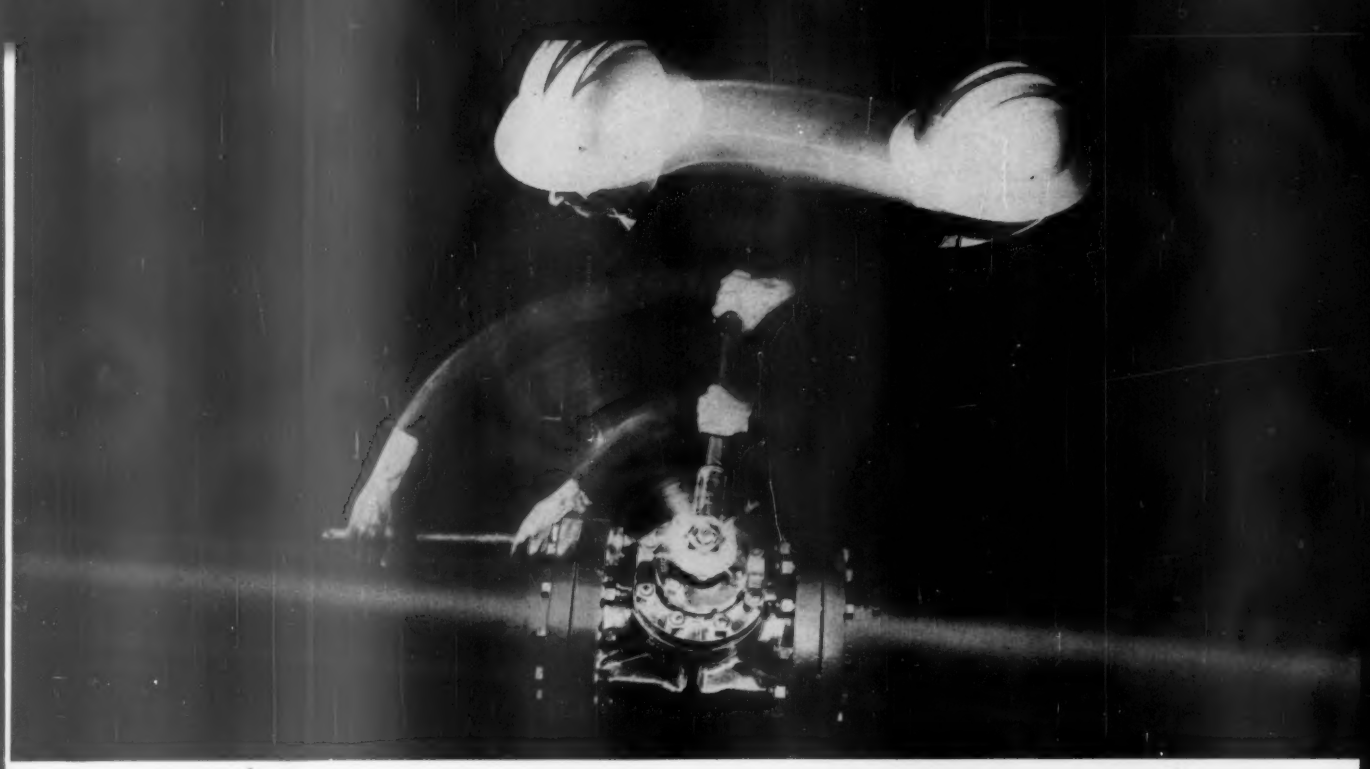


Stroboscopic photo shows fast, smooth quarter turn closure of Rockwell-Nordstrom lubricated plug valves.

THESE LUBRICATED VALVES CLOSE 2 TO 5 TIMES FASTER

Rockwell-Nordstrom *lubricated* plug valves save time, reduce flow control errors because they close quickly, positively and easily with just a quarter turn. One man can open or close a dozen of these valves in the time it takes to laboriously wrestle one hand wheel on other types of valves.

Faster closure isn't the only advantage of Rockwell-Nordstrom lubricated plug valves. Their Sealdport pressurized lubrication system insures positive shut-off by creating powerful seals of hydraulically energized lubricant at the seat ports. And, isn't it just common sense that any lubricated mechanism will work better, longer and at far lower cost than a "dry" one? Get complete details on Rockwell-Nordstrom lubricated plug valves (the world's most complete line) by writing: *Rockwell Manufacturing Company, Pittsburgh 8, Pa.; Canadian Valve Licensee, Peacock Brothers Limited; Rockwell International S.A., Geneva, Switzerland.*

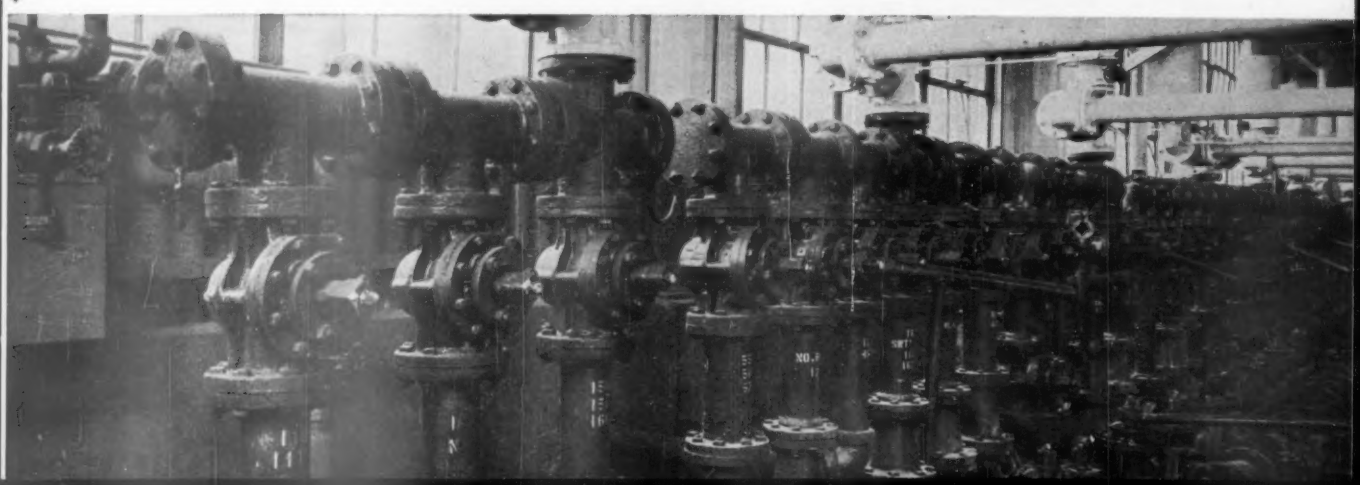
Lubrication Makes The Difference

ROCKWELL-Nordstrom VALVES

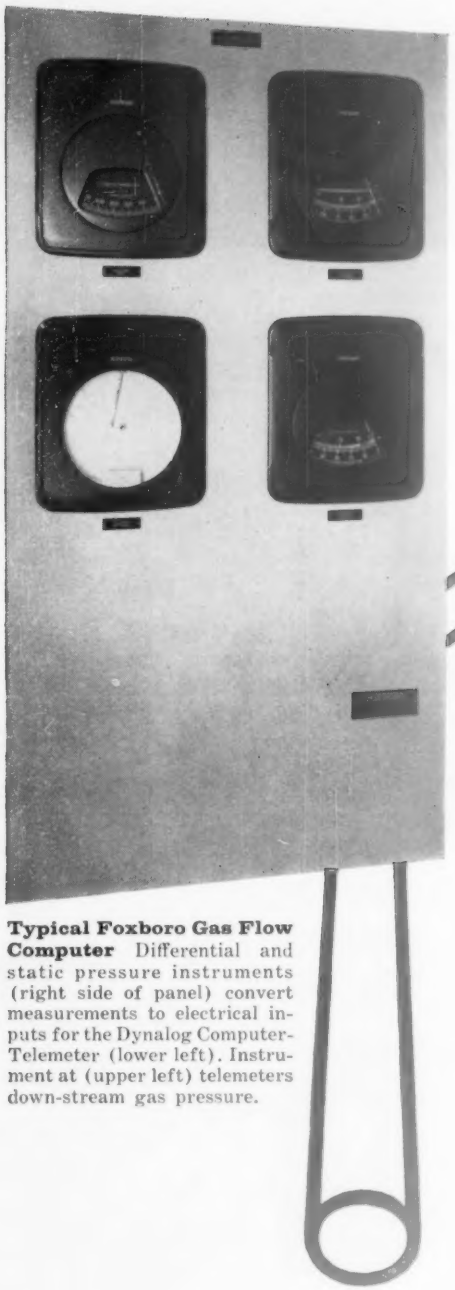
another fine product by

ROCKWELL

One man can open or close this refinery transfer manifold 3 times faster than three men winding handwheels on ordinary valves.



"packaged" automatic gas flow computer systems



Typical Foxboro Gas Flow Computer Differential and static pressure instruments (right side of panel) convert measurements to electrical inputs for the Dynalog Computer-Telemeter (lower left). Instrument at (upper left) telemeters down-stream gas pressure.

piped, wired, calibrated ready for installation

A continuous record of gas flow — into or out of your pipelines — that's the information a dispatcher gets automatically with the Foxboro Gas Flow Computer.

Foxboro systems do their computing at the meter station, automatically compensating for gas temperature and pressure, and transmit total flow values. Transmission errors common to systems that compute at the receiving end are eliminated. Transmission line space is saved as well.

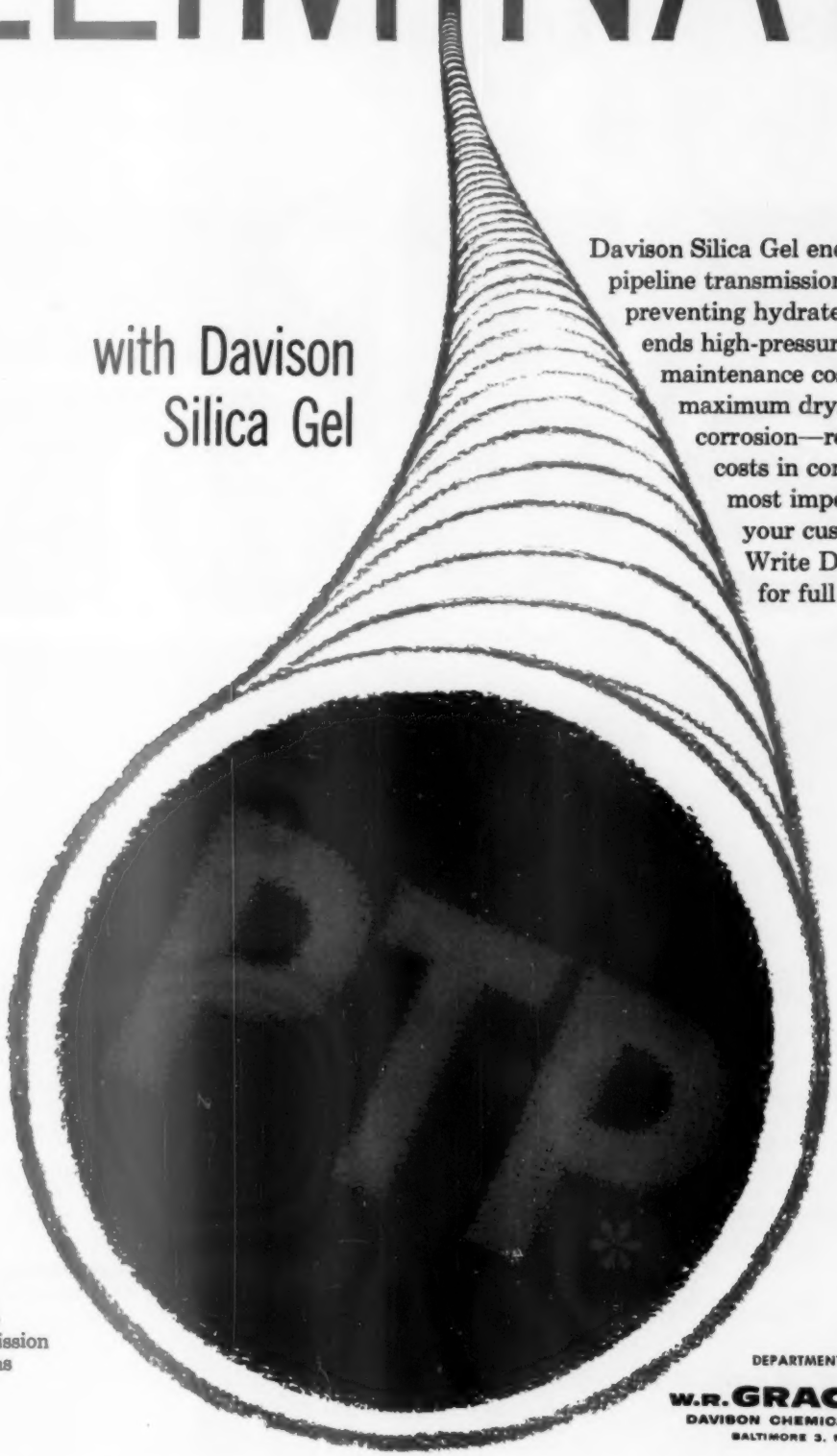
Foxboro Gas Flow Computers are furnished as a complete packaged unit — calibrated and tested as a system before shipment. Installation is as simple as setting the panel unit in place — making connections. Computers are available for both single and multiple meter runs.

Ask your local sales engineer about the Foxboro Gas Flow Computer. He can tell you about many installations in successful operation. **The Foxboro Company, 606 Neponset Avenue, Foxboro, Mass.**

FOXBORO
REG. U.S. PAT. OFF.
Instrumentation

ELIMINATE

with Davison Silica Gel



Davison Silica Gel ends natural gas pipeline transmission problems. By preventing hydrate formation, it ends high-pressure losses—lowers maintenance costs. By providing maximum dryness, it decreases corrosion—reduces power costs in compression—and, most important, keeps your customers happy. Write Dept. 3106 today for full information.

* Pipeline Transmission Problems

DEPARTMENT 3106

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DAVISON CHEMICAL DIVISION
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Seamless pipe and tubes

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See : the Composite Catalog of Oil Field Equipment and Services 1960 - 61 pp. 3820 to 3826

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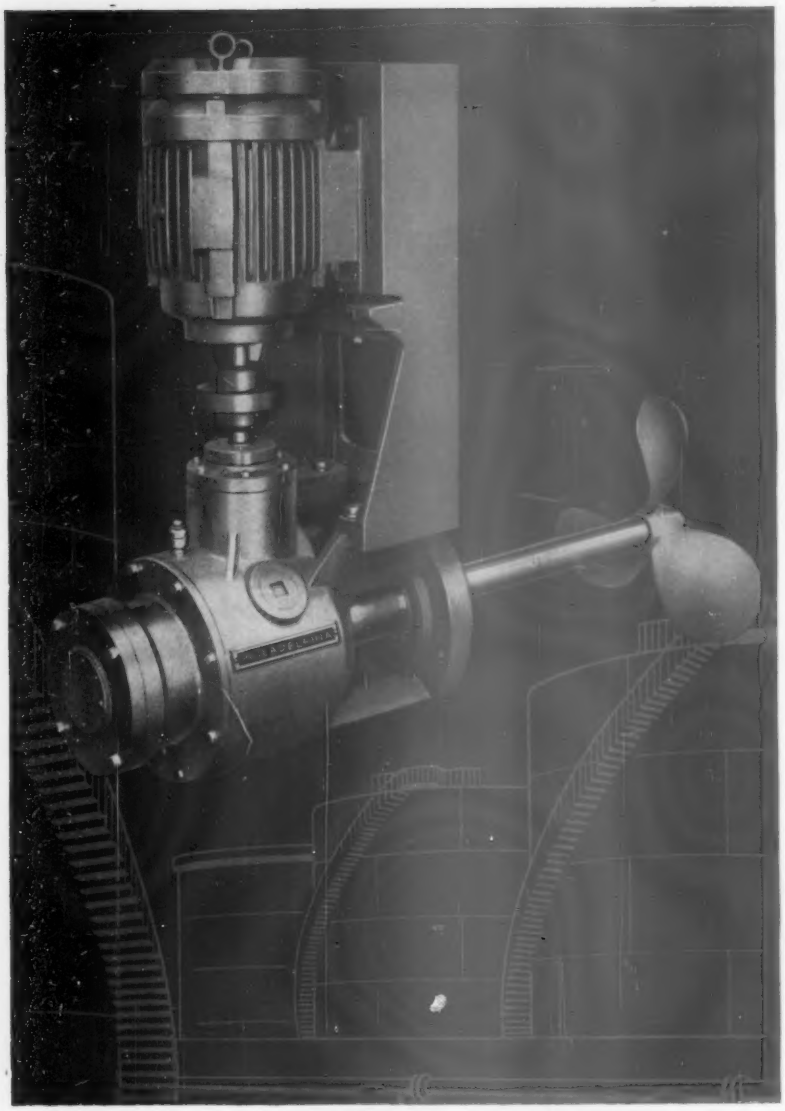
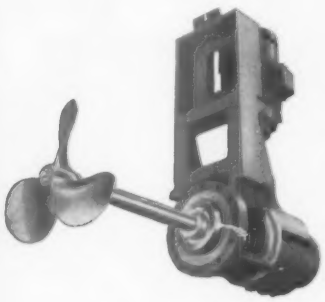


NEW from Philadelphia...
SIDE ENTERING MIXERS

And there is plenty that's *new* about them. Shorter, more compact; they minimize the need for mounting braces. Reducer and reducer support stand housing is one piece to provide more rigid support for bearings, shafting and gearing. In short, these new mixers are designed for the job . . . not adapted to it. They overcome all the problems inherent in mixers that are a collection of components designed for other purposes.

And if you are looking for better mixing, these new Philadelphia mixers will deliver it. Large volumetric flow means thorough top-to-bottom turnover, even in the largest tanks. As for cost, Philadelphia side entering mixers cost less than *any mixer* of comparable quality.

NEW
FROM EVERY ANGLE



COMPACT. This is an extremely compact mixer. Weight is centered close to the tank wall. There's less overhang . . . less strain on tank walls and nozzles. Need for bracing at points other than the mounting flange is minimized.

HIGH CAPACITY GEAR REDUCER IN MIXER DRIVE. The capacity of the precision spiral bevel drive, using maximum standard motor sizes, is more than twice AGMA requirements. This means far greater gear life than normally required.

ONE PIECE GEAR REDUCER AND REDUCER SUPPORT STAND HOUSING. Rugged and rigid, it is designed for large, high capacity bearings, and large-diameter shafting. Result: truer running agitator shafting and reduced maintenance.

DEPENDABLE SHUT-OFF ARRANGEMENT. The mechanical seal is a cartridge unit. One man can change it quickly and easily with a full head of liquid in the tank, without moving the mixer in any way.

TRUE RUNNING SHAFTS. Minimum distance from reducer to shaft seal, combined with large diameter shafting, means less run-out at the seal. Mechanical seals last longer. Packed stuffing boxes require far less maintenance.

SIMPLE, FOOLPROOF LUBRICATION. Time-tested oil splash system provides correct lubrication to gears and bearings.

For better mixing, and a better mixer, get all the details. Write for Catalog PSE-60. Sizes: Model 08, 1 to 7.5 HP; Model 11, 10 to 25 HP.

PHILADELPHIA GEAR CORPORATION
King of Prussia, Pennsylvania
(Suburban Philadelphia)

philadelphia mixers

Here's why a GROVE G-5 never needs maintenance

The big reason you can hook up a Grove G-5 and forget it is the famed Grove full opening "big valve" design. You get (1) precision ground, chrome plated and polished side plates for positive metal to metal seal, backed by (2) proven Grove protected Seal-O-Rings on both sides of the gate, for (3) up and down stream seal. Because the Seal-O-Rings are on the gate (4), they are out of the flow at all times, protected from damage caused by contaminates in the bore.

The big plus feature — Grove G-5 valves never need lubrication. Grove series 150 G-5 valves are available in lever or handwheel operated models, sizes 2" through 36".

GROVE VALVES

GROVE VALVE and REGULATOR COMPANY

A Subsidiary of Walworth

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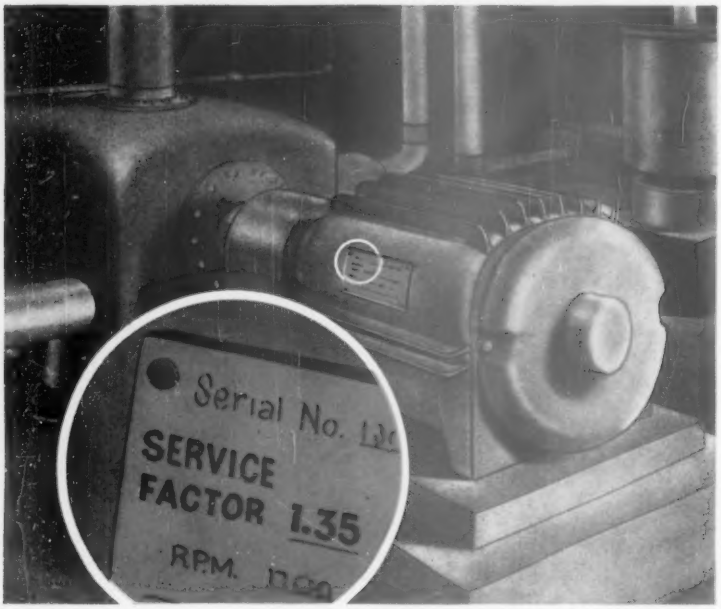
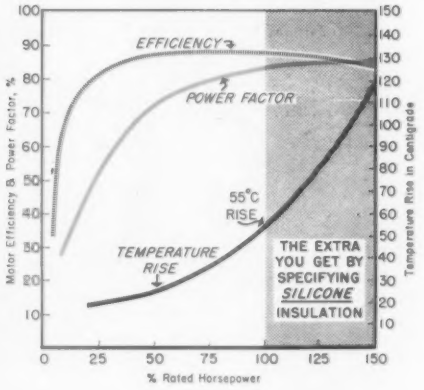
6278

New Service Factor Motors Cut Costs





Specify High Service Factor Motors for lowest initial cost, lowest operating costs . . . maximum reliability.

Leading manufacturers now offer motors designed to an entirely new concept. These motors are available in standard NEMA frames of the same size used for conventional motors of the same rating, but look alikes don't perform alike.

These new motors, insulated with Dow Corning Silicones, have a built-in reserve to carry overloads of twenty-five to fifty percent above nameplate horsepower rating. Here's what this means to you:

Simplified Motor Specifications: Specify motors that are silicone insulated for high service factor. With nameplate horsepower ratings identical to nominal loads, these motors will handle temporary, or even continuous overloading. No need to calculate maximum possible load and add a safety factor. It's already built in.

More Efficient Power Use: Power factor problems are reduced . . . excessive power bills resulting from part-load motor inefficiencies are brought in line. Because motors operate at rated output, the need for capacitors to correct power factor is substantially reduced.

Less Installed Horsepower: With motors rated to match normal loads, total installed plant horsepower will be substantially less. Using conventional methods of determining distribution system needs, transformer and switchgear requirements are lower—less costly units can be safely specified.

Motors insulated with Dow Corning Silicones for high service factors are available now from leading motor builders. For more information on what silicone insulated equipment can mean to you, write Dept. 6206.

How do manufacturers build so much extra into a motor? By substituting an insulation system made from Dow Corning Silicones for the Class A insulation system used in standard lines. Only the insulation changes. Frame, electrical steel and copper remains the same. And there's one change on the nameplate.

Service factor rating goes up. On a TEFC motor, for example, service factor goes up from 1.00 with Class A insulation materials to somewhere between 1.25 and 1.50 when silicones are used, depending on manufacture and horsepower rating.

Handling liquid of varying viscosity, this 5 hp, 1.25 service factor motor withstands overloads, including those created by excessive tightening of pump packing glands.

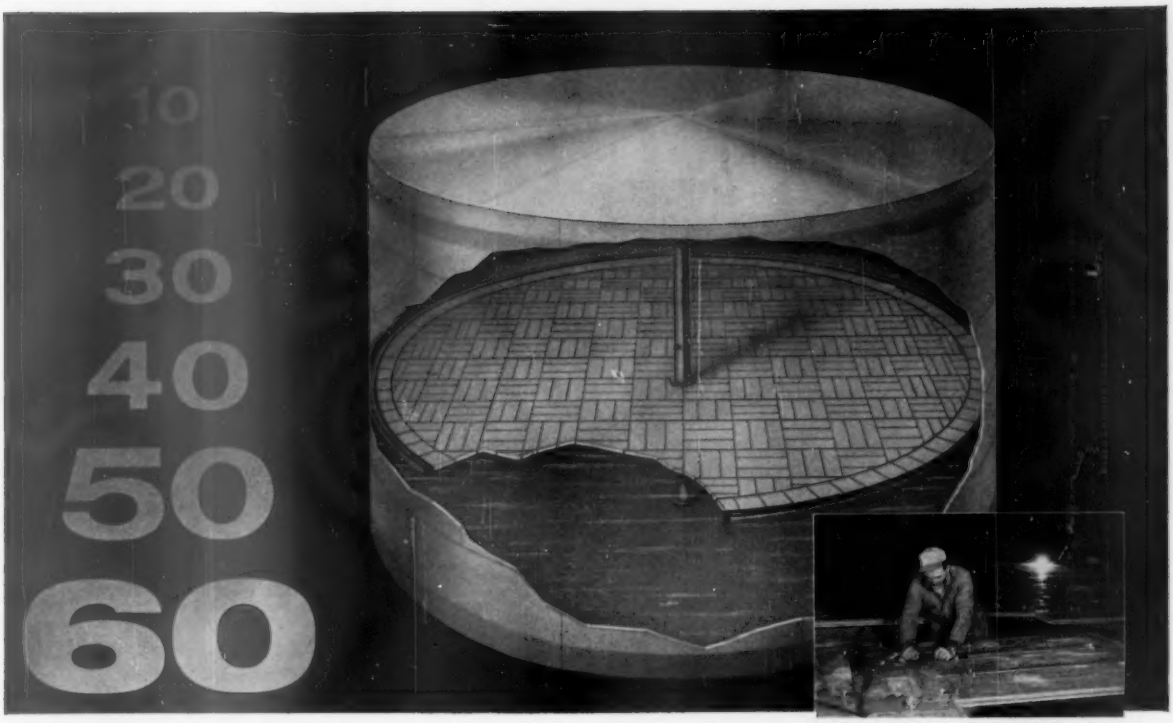
Motors insulated with Dow Corning Silicones give reliable operation in almost any surroundings—regardless of high ambients, moisture, many corrosive atmospheres. And on the basis of capability, high service factor motors generally cost less than conventional motors.

SPECIFY Dow Corning Silicones and SAVE!

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.



70 ft. HAMONDFLOTE COVER

converts old riveted vessel to modern floating roof tank

A rigid foam plastic Hamondflote Cover was quickly and easily installed in this 70 ft. diameter riveted tank. Using conventional hand tools in a simple assembly operation, maintenance personnel converted the vessel to an efficient conservation tank.

SIZE IS NO LIMITATION . . . the Hamondflote Cover can be used to modernize tanks up to any diameter in use today, regardless of the number or location of supporting columns. It reduces evaporation losses by as much as 95%, is completely resistant to a wide range of chemicals and petroleum hydrocarbons and will withstand temperatures from −94°F. to +300°F.

Write for bulletin which tells the entire Hamondflote Cover story.

1. Sections of the Hamondflote Plastic Cover are easily put together with tongue and groove joints and simple hand-tightened clamps.

2. Here the 70 ft. Cover is almost completed. Note that it is strong and rigid enough to support the workman's weight.

3. Rivets, columns and other protrusions on the inside wall of the tank present no problems. The flexible packing gland easily slides over them when the roof is rising or falling with the liquid level.

HAMONDTANKS — 12 plants to serve you coast to coast — PDM ENGINEERS · FABRICATORS · CONTRACTORS

Pittsburgh-Des Moines Steel Company

Plants at PITTSBURGH, WARREN, BRISTOL, PA. • BALTIMORE • BIRMINGHAM • DES MOINES
PROVO, UTAH • CASPER, WYO. • SANTA CLARA, FRESNO, STOCKTON, CALIF.

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MY CREWS DO A FASTER JOB with GUIBERSON SWABS

There's no substitute for a fast-falling, smooth-pulling Guiberson swab in speeding-up swabbing operations. Crews make fewer trips .. do a better clean-out job .. lift more fluid per hour. So naturally they're in and out quicker .. at the *lowest possible* swabbing cost. Match one of these cups to your swabbing job.

TYPE J .. lifts heaviest loads
TYPE L .. lifts medium or light loads
TYPE GW .. for light loads
TYPE K .. general purpose cup to 6,000 feet
SIMPLEX .. lifts fluid containing suspended sand

More than a third of a century of swab-making experience is behind each Guiberson swab and cup. No matter what type of production .. shallow or deep .. light or heavy loads .. smooth, rough or tight tubing .. you will pull more fluid with Guiberson swabs and cups. Regardless of your swabbing problem, you can meet it .. solve it .. quicker and cheaper with a Guiberson swab.

Cups are compounded to Guiberson's exclusive formulas for maximum resistance to oil .. acid .. abrasion.

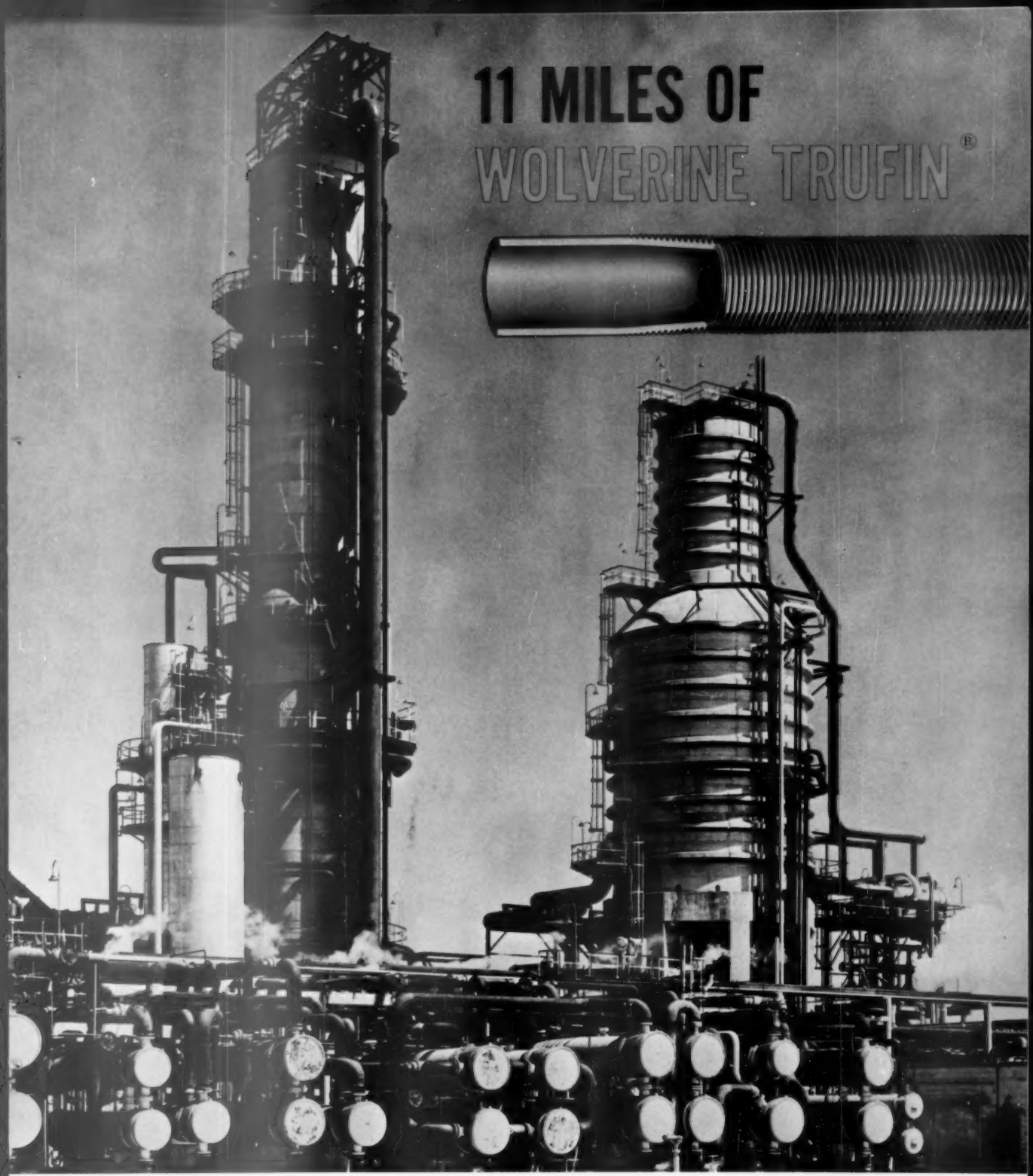
NO BETTER BE SAFE THAN SORRY GUIBERSON

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

ONE OF THE DRESSER INDUSTRIES

Sold by
Oil Field Supply Stores
Everywhere



More than 11 miles of Trufin Type S/T–the integral finned tube–have been used in nine of the shell and tube heat exchangers which are the heart of the world's largest crude oil pipe still. Located in a midwestern refinery, the still is producing 140,000 barrels per day! More than 95% of the Trufin involved is made from Admiralty Brass.

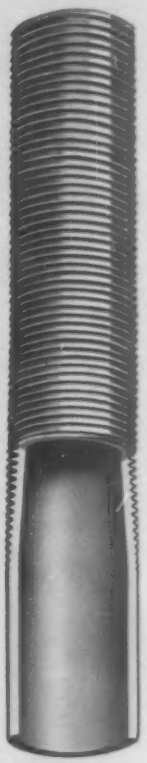
Yes, 11 miles of Trufin is a lot of tube–but just visualize the space savings that Trufin has provided. To perform the same heat duty as Trufin, more than 20 miles of prime surface tube would have had to be used. The advantages are obvious–fewer tubes, fewer shells, much less space required, and more production.

The complete range of finned tube products made by Wolverine Tube is shown on the other side of the page. It's a product line proven by experience.

Write today for more information.

Wolverine Tube manufactures the industry's most complete line of finned tube

PRIME SURFACE TUBE

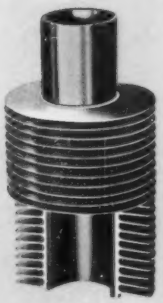


WOLVERINE TRUFIN TYPE S/T

WOLVERINE TRUFIN TYPE W/H

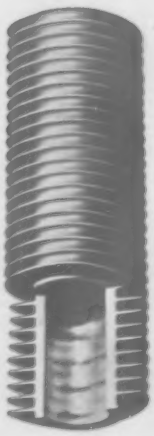
DUPLEX PRIME SURFACE TUBE

DUPLEX WOLVERINE TRUFIN, TYPE S/T



WOLVERINE TRUFIN TYPE L/C
Bimetal

WOLVERINE TRUFIN TYPE H/R



WOLVERINE TRUFIN TYPE H/A

WOLVERINE TRUFIN TYPE I/L

FINNED AND PRIME SURFACE U-BENDS
arranged in a disposable box-type pallet

LET US TELL YOU ABOUT IT

WOLVERINE TUBE
DIVISION OF
Calumet & Hecla, Inc.
DEPT. B, 17238 SOUTHFIELD RD., ALLEN PARK, MICH.
Manufacturers of Quality Controlled Tubing

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES

VOGT identification Disc...

...on top and in sight

makes it easy to identify valves —even in insulated lines

The Vogt tell-all identification disc, on every valve, is permanently located above the handwheel for complete and convenient identification. It shows valve size, catalog and drawing number, materials used for principal parts and primary pressure and temperature ratings. The flat on the handwheel protects the disc in assembly and in service.

Vogt GP Valves are available in a complete range of sizes from ¼" to 2", with HAYNES STELLITE* faced seating surfaces and rated 800 pounds at 850° F. and 2000 pounds at 100° F. (Other types are available through 8" size.)

* Union Carbide Corporation

HENRY VOGT MACHINE CO.
P. O. BOX 1918, LOUISVILLE 1, KY.

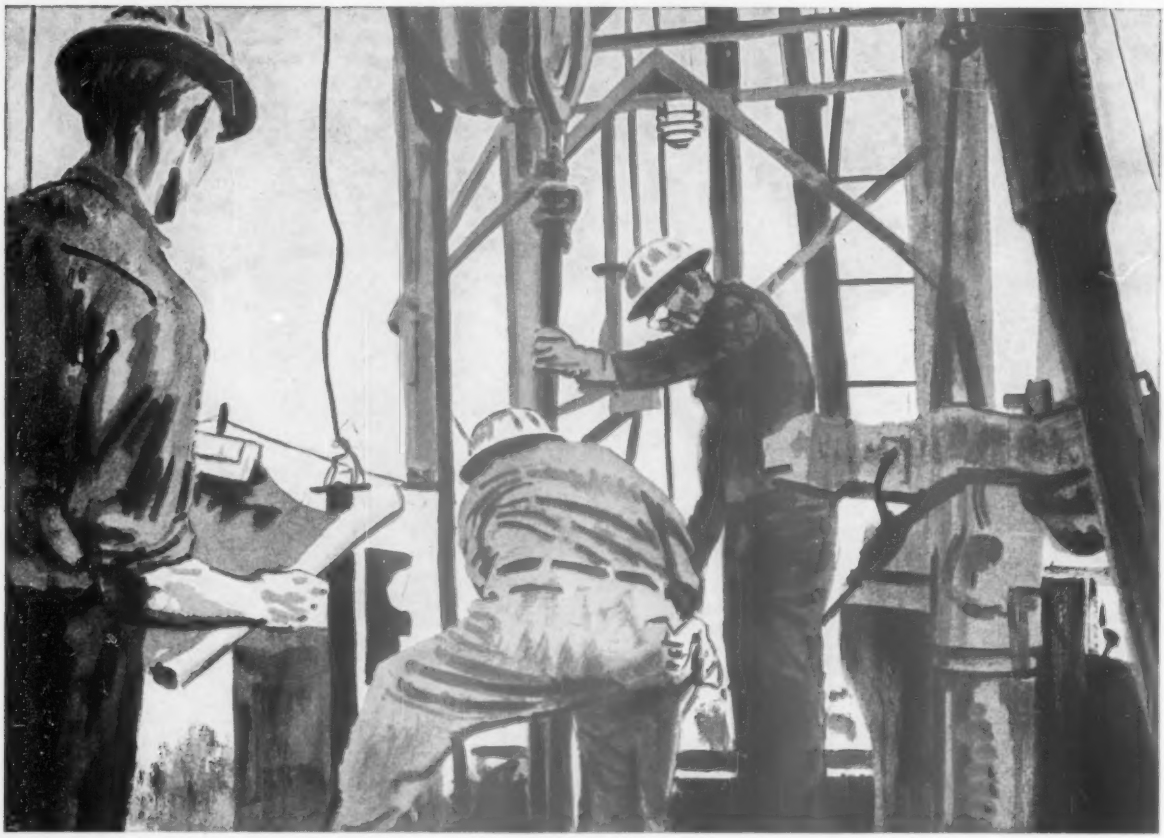
SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati, Los Angeles.

Catalog F-10 is available to you—please send request on your company letterhead. Address Dept. 24A-FO.

Vogt GENERAL PURPOSE **GP** Vogt FOR BETTER VALVES & FITTINGS

FORGED STEEL

VALVES



TAKES THE TORQUE OFF THE STRING

SMOOTHER THAN STEAM

"MAKES THE DIFFERENCE BETWEEN A GOOD RIG AND A BAD ONE"

"Shale balling up around the stabilizer puts a heavy shock on our string. If it weren't for TORQMATIC DRIVE absorbing the shock, we'd never be able to drill this hole."

That's J. W. "Frenchy" Seilhant talking. He's Drilling Super for Farr-Bolton Production Company—bosses the company's Cooper rig working in Texas' Bethany Field.

It's a small lease—so directional drilling is a must. And, because the hole must be accurate to ¼ degree, he has to make a round trip every 100 feet to check direction.

This short rig takes less than three hours to make a 3800-foot round trip. Reason? TORQMATIC's quick-shift lets the driller come off bottom in low then snap into high gear to speed the string.

"Frenchy" says, "That quick change will beat 'em all . . . in fact, TORQMATIC makes the difference between a trouble-free rig and a bad one. Take the shock off the equipment as TORQMATIC does and your rig is bound to run better and last longer."

You'll beat a lot of your rig troubles if you put an Allison TORQMATIC DRIVE to work for you. They're available in drilling, servicing and fracturing equipment made by most leading oil field equipment manufacturers. Details? See your dealer or write Allison Division of General Motors, Indianapolis 6, Indiana. In Canada: General Motors Diesel Limited, London, Ontario.

Allison

TORQMATIC® DRIVES

THE MODERN DRIVE FOR MODERN EQUIPMENT

Do you check these points When Buying **STAINLESS STEEL** *Valves?*

- ☐ **How good are the castings?**
- ☐ **How precise is the machining?**
- ☐ **How rigid are the inspection and testing?**
- ☐ **How sound is the design?**

Just as important as a suitable stainless steel alloy are these four checks on valve quality. For long, dependable performance, a valve should rate *perfect* on every one.

There's a very good reason why you can be sure Jenkins Stainless Steel Valves will do that, unvaryingly:

For almost a century Jenkins has specialized in making valves. And making them to one standard of quality . . . the highest. Every operation and every worker is aimed at fulfilling that standard. The result is a product that can be backed by this 91-year-old assurance for valve users:

A Fair Offer

If you will put a Jenkins Valve, recommended for your particular service, on the worst place you can find . . . where you cannot keep other valves tight — and if it is not perfectly tight or it does not hold steam, oil, acids, water or other fluids longer than any other valve, you may return it and your money will be refunded.

Order these reliable Jenkins Valves from your local Jenkins Distributor. Ask him or write us for Stainless Steel Catalog No. 59SS. Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere

NEWS FROM DOWN THE LINE!

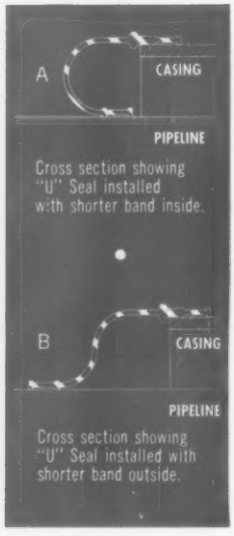
A NEW VERSATILE AND ECONOMICAL SEAL FOR CASED CROSSINGS...

THE NEW WmSON "U" SEAL

❶ "This new WmSon "U"-Seal maintains a tight seal regardless of what position the drag section assumes inside the casing."

❷ "This is a special demonstrator to show the flexibility of the "U"-Seal. Notice how it maintains its seal regardless of the change in pipe position in relation to the casing."

❸ " . . . Here the "U"-Seal is shown installed in the new "U" shape with the shorter band inside , which allows extreme flexibility. The "U"-Seal can also be installed with the shorter band on the outside in WmSon's familiar "Z" shape. In either case, only a screwdriver is needed to tighten the two stainless steel bands."



SIZES 2" AND LARGER

❹ Regardless of which way you install the "U"-Seal (Fig. A or fig. B) . . . . Regardless of what position the drag section assumes . . .

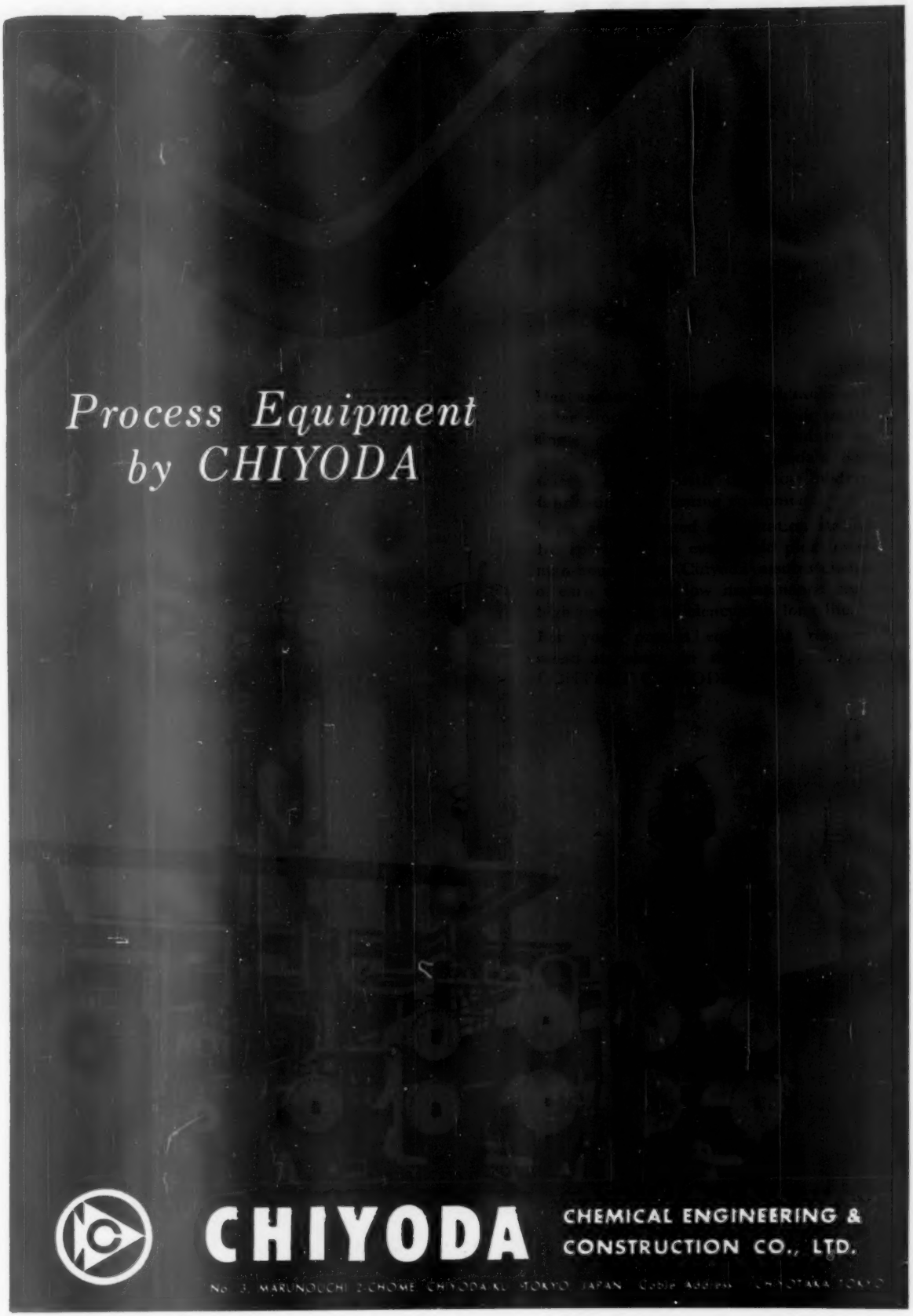
YOU CAN SEAL WITH A "U"-SEAL!

Write Dept. A for Bulletin A-281

T. D. Williamson, Inc.

P. O. BOX 40 TULSA 2, OKLAHOMA

REPRESENTATIVES AROUND THE WORLD


Process Equipment
by CHIYODA
CHIYODA
CHEMICAL ENGINEERING &
CONSTRUCTION CO., LTD.
No. 3, MARUNOUCHI 2-CHOME CHIYODA-KU TOKYO JAPAN Cable Address CHIYOTAKA TOKYO

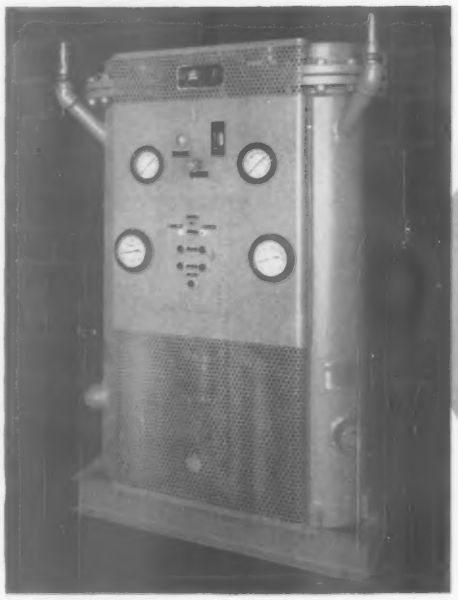
KEMP ORIAD DESICCANT DRYERS

stop moisture best, cost less 3 ways!

1 Complete reactivation
An exclusive 3-zone embedded-heater design gives every KEMP ORIAD DESICCANT DRYER unmatched extra-drying power. Reactivation is always complete and uniform in *any* drying process of air, gases or liquids, assuring maximum desiccant capacity—minimum dew-point performance.

2 Perfect temperature control Heat input is conserved by thermostatic control . . . ideal temperatures are maintained for the highest operating efficiency at the lowest operating costs. An alarm system guards the entire network.

3 Full automatic operation A simple setting of the program timer, and everything is automatically regulated. Drying results with the least pressure loss, lowest operation and maintenance cost. For further details, write for Bulletin D-103 . . . or call your local Kemp Man listed in the Chemical Engineering Catalog.



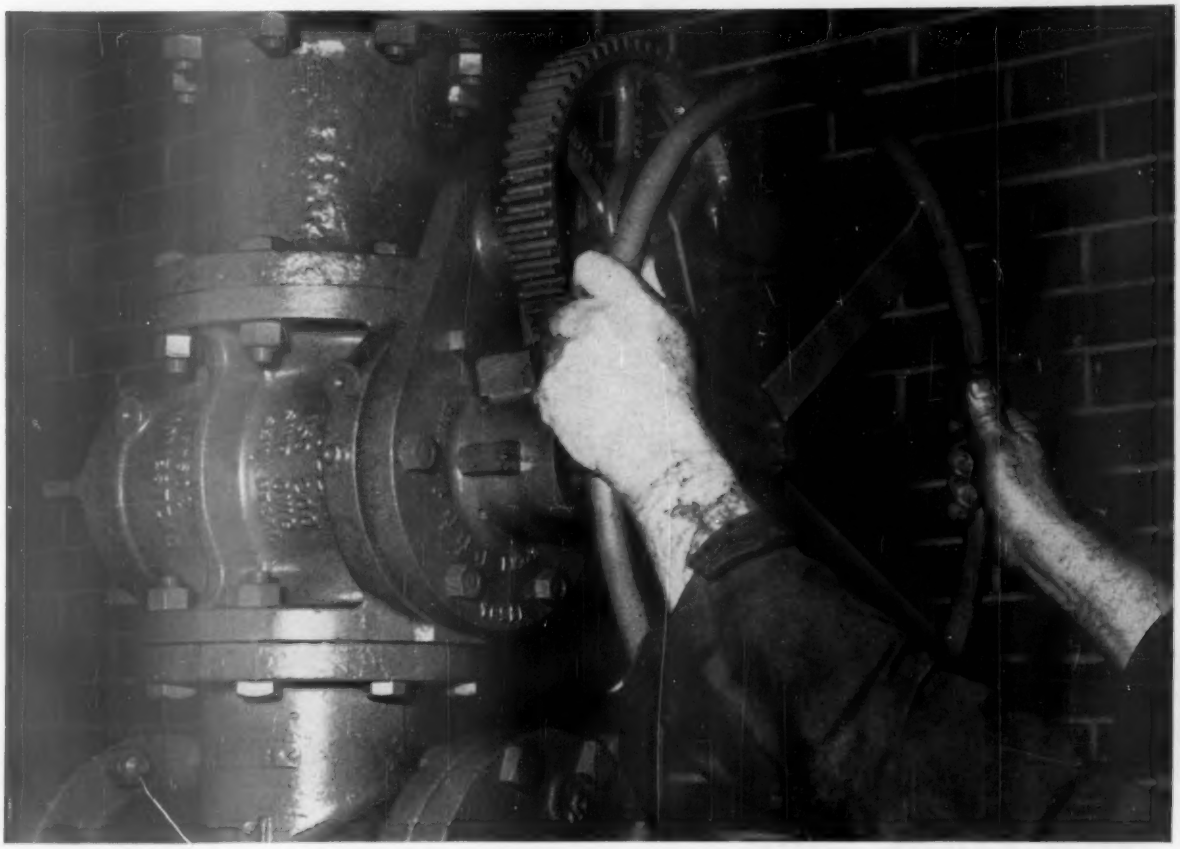
It always pays to come to

KEMP OF BALTIMORE

THE C. M. KEMP MANUFACTURING CO.
405 E. Oliver Street • Baltimore 2, Maryland

100% FLUID CONTROL AT YOUR FINGERTIPS

with Homestead Lubricated Plug Valves. When open, they provide full pipe-sized passage to fluids. Closed, their controlled high pressure lubricant



system, plus extremely close plug and body tolerance, guarantee a complete chemical seal—positive shut-off without contamination of line fluids. Instant response is sure, too, because piston-like movement of plug during each lubrication prevents sticking. They are low in first cost—low in upkeep. Write for complete details.

hv

HOMESTEAD VALVE MANUFACTURING COMPANY
P.O. Box 406, Coraopolis, Pennsylvania

Gentlemen: Please send me Catalog 39-1 and prices on Homestead Lubricated Plug Valves 406

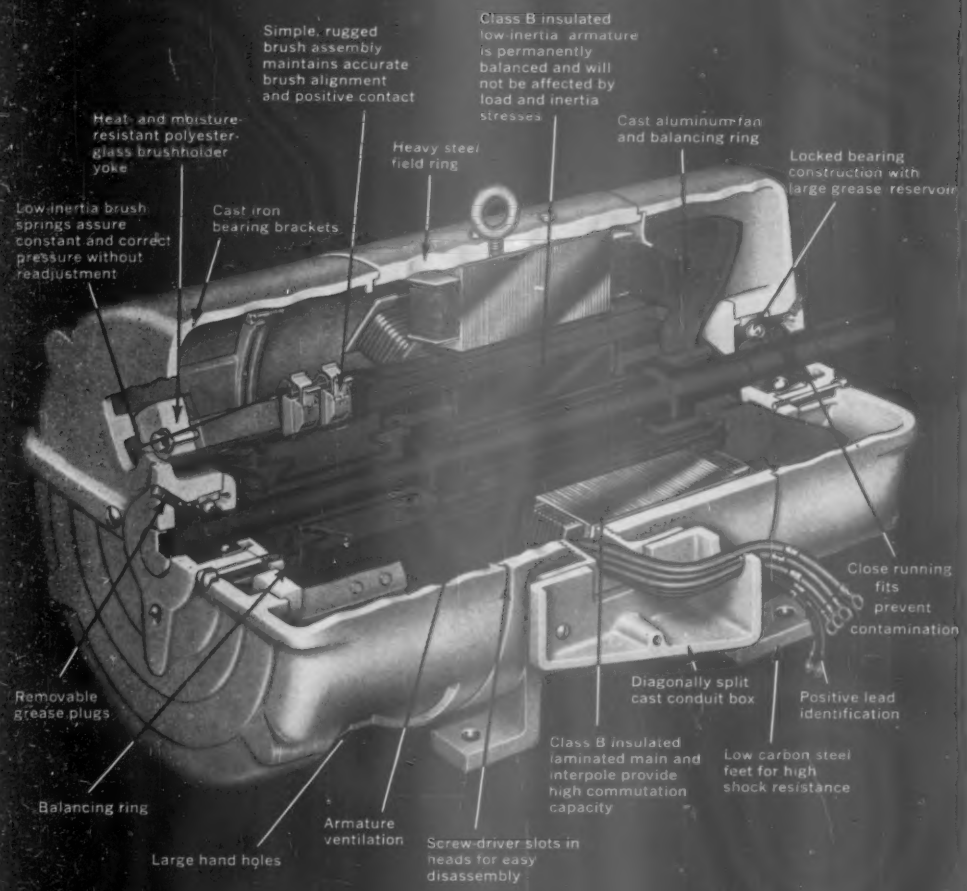
Name..... Title.....

Company.....

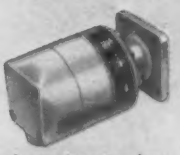
Address.....

City..... Zone..... State.....

Here's the latest in D-C motor design:


Simple, rugged brush assembly maintains accurate brush alignment and positive contact
Class B insulated low-inertia armature is permanently balanced and will not be affected by load and inertia stresses
Heat- and moisture-resistant polyester-glass brushholder yoke
Heavy steel field ring
Cast aluminum fan and balancing ring
Locked bearing construction with large grease reservoir
Low-inertia brush springs assure constant and correct pressure without readjustment
Cast iron bearing brackets
Close running fits prevent contamination
Diagonally split cast conduit box
Positive lead identification
Removable grease plugs
Class B insulated laminated main and interpole provide high commutation capacity
Low carbon steel feet for high shock resistance
Balancing ring
Armature ventilation
Large hand holes
Screw-driver slots in heads for easy disassembly

...and some easy-to-add field modifications



A-c tachometer for speed indication

A-c motor-driven blower with permanent dry-type filter for easy mounting on bearing bracket

Magnetic disc-type brake with d-c series or shunt, or a-c coils

Helical single, double, and triple reduction gear units for all ratios

New Louis Allis FLEXITORQ® D-C MOTORS

...offer you vastly improved commutation–low brush wear–400% short-time overload capacity–and unmatched flexibility!

Bear this in mind: The Flexitorq is *not* just another *rerated* d-c motor. It's *all new*—and it's been designed to give you more for your power dollar — in superior performance, matchless field flexibility, and unrivalled economy of operation and upkeep.

Advanced armature design and brush construction offers improved commutation, faster response, and lower brush wear. Class B insulation system provides exceptional thermal endurance... is rated for 60°C rise for continuous duty... and creates a barrier to moisture, acids, alkalis, and other contamination.

The net result to you is reliable, trouble-free power for constant and adjustable speed drives. For example, Flexitorq gives you 400% faster acceleration, plus much better deceleration, reversing, and speed changing. You can safely impose 400% intermittent and 15% continuous overloads — and the high-torque design is a welcome plus when you need extra power for hard-to-start machines.

The new Louis Allis Flexitorq is lighter and more compact than previous d-c motors... lets you squeeze more power into less space... yet is actually *easier* to service! Brushes and entire brush-holder assemblies can be quickly inspected and removed without major disassembly. And since brush springs remain conveniently attached to the brush holders, brush changing is a simple affair.

Flexitorq d-c motors are available in sizes from 1 to 400 hp — in various enclosures. See your nearby Louis Allis District Office for information and application help. Or write for Bulletins 3150 and 3200 to The Louis Allis Co., 449 E. Stewart St., Milwaukee 1, Wis.

LOUIS ALLIS

DC-217

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

Naugatuck KRALASTIC

Underground corrosion steals $600,000,000 a year!* but KRALASTIC ABS pipe can't corrode

It can't rust or rot—is free from electrolytic action—impervious to water and the usual soil elements—highly resistant to most chemicals. Pipe made of KRALASTIC®, the original ABS rubber-resin, never needs coating, lining or anode protection.

What's more, amazingly tough KRALASTIC pipe gives a host of other advantages over conventional pipe materials.

- KRALASTIC pipe is extremely lightweight—needs no heavy handling equipment or costly bedding.
- It can be snaked through many existing lines—eliminates much time- and money-wasting ditching.
- It offers extremely low internal friction—will not accumulate scale.
- It can be quickly and easily solvent welded—with just the stroke of a brush. Or it may be threaded and used with threaded fittings.
- KRALASTIC has outstanding impact strength—even at arctic temperatures.

In short, KRALASTIC is a noncorroding pipe material with a combination of properties no other pipe material can match.

Proof of KRALASTIC pipe performance? More than 9,000 miles of KRALASTIC pipe have been specified, installed and are now in trouble-free service carrying potable water, brine, gas, a wide variety of chemicals and even electrical wire and cable. KRALASTIC pipe has been approved by the National Sanitation Foundation and is already accepted in many local plumbing codes.

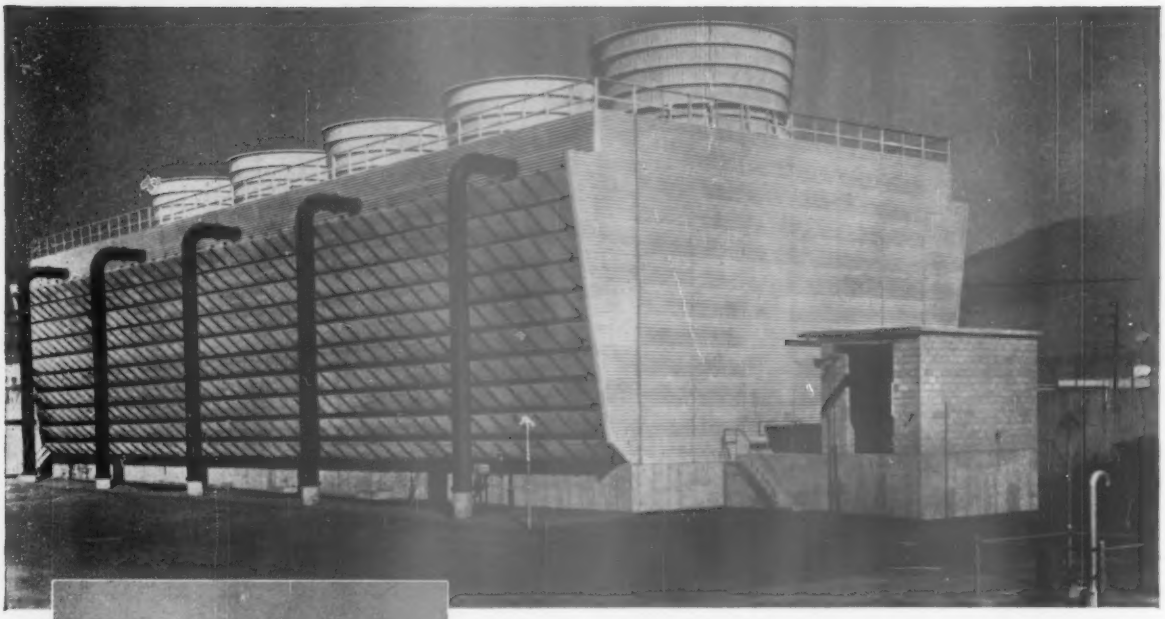
Better look into KRALASTIC, the original ABS, today. Simply write on your letterhead to the address below.

*Estimate of the National Bureau of Standards

United States Rubber
Naugatuck Chemical Division
DEPT. 616K ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.



WAGNER® MOTORS HELP MARLEY TOWER

At work on the fan deck: Five Wagner Type EP, 75 hp, 480 volts, 1750 RPM Motors.

PRODUCE *MORE POWER* FOR BURBANK

This is the new Marley Class 600 Double-Flow 5-cell cooling tower at the power station of the City of Burbank, California ... the newest thing in cooling tower design. Its job: to cool water to get more kilowatts from steam.

Wherever water cooling is vital to plant capacity, product quality or customer comfort, chances are you'll find a Marley Cooling Tower. You'll probably find Wagner® Motors there, too. They're on this tower in Burbank, driving the huge fans used in the tower's cells.

The job is a rugged one. It calls for motors that can operate without attention month after month ... motors that can stand constant exposure to all kinds of weather and to high humidity, the number one cause of motor failure in cooling tower applications.

Wagner Type EP Motors meet these requirements. All vital parts of these workhorse motors are totally enclosed, and are sealed against moisture by a series of grease retaining grooves between shaft and housing. Running shaft seals, at both ends of the frame, prevent the entrance of water into the bearing housings. The frames, endplates and conduit box are made of heavy cast iron for extra protection against high humidity and corrosion.

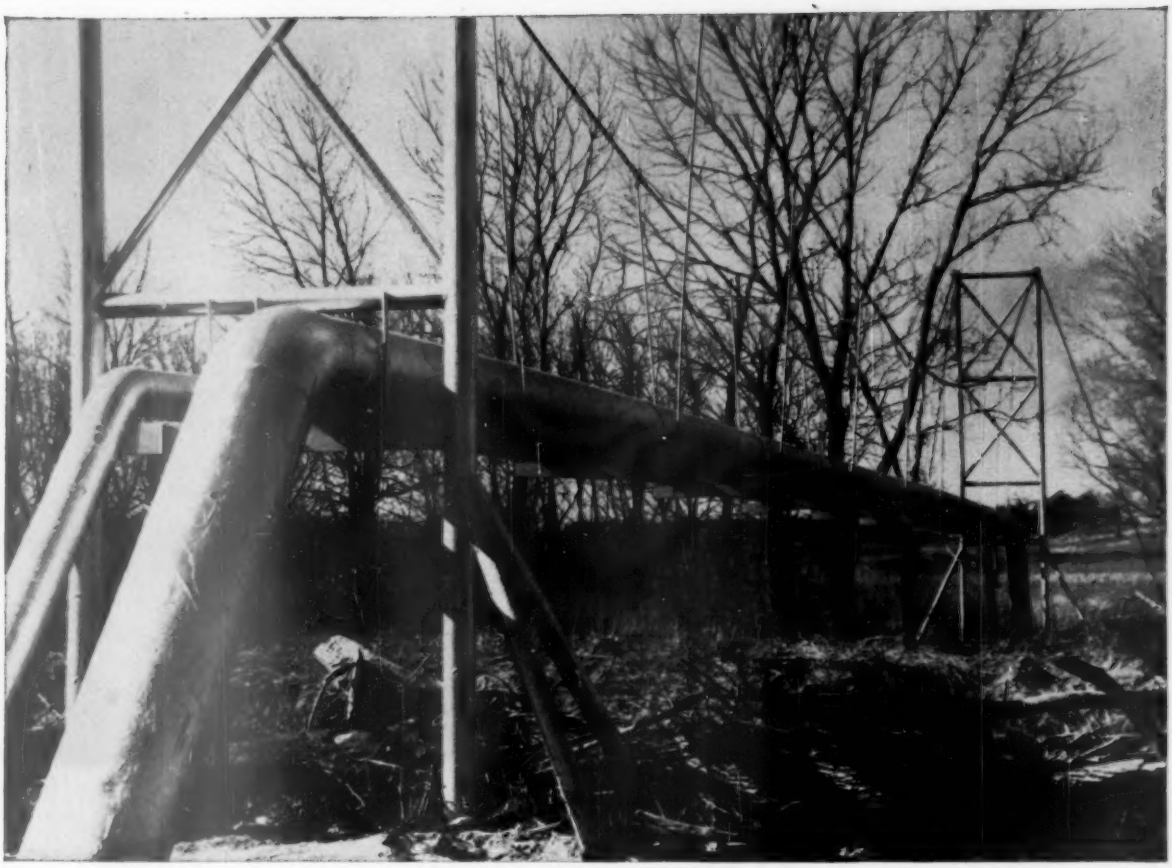
What about your requirements for motor drives that must operate under adverse conditions? Versatile Wagner Totally-Enclosed Motors can meet them, whatever the application. They are available in standard ratings through 500 hp. Call your nearby Wagner Sales Engineer for full details, or write for Bulletins MU-224 and MU-230.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6389 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WM60-17



Don't Pay for "Extra" Steel— Specify Armco Line Pipe

New steels are born at Armco

Suppose you are planning a pipe line that calls for 16-inch-diameter steel pipe with .172-inch minimum wall thickness. There is no need for you to settle for the .250-inch thickness available from most suppliers. Armco has 132 different diameter wall thicknesses, enabling you to meet your requirements *exactly* . . . without buying "surplus" steel.

Armco Pipe is supplied in lengths up to 50 feet instead of the ordinary 40-foot or double-random lengths. The longer lengths mean fewer field joints—you save welding and handling time.

Get complete details. Send us the coupon below for a copy of Armco's Welded Steel Pipe Catalog for the Oil and Gas Industries. Armco Drainage & Metal Products, Inc., 4570 Curtis Street, Middletown, Ohio.

ARMCO DRAINAGE & METAL PRODUCTS, INC.
4570 Curtis Street, Middletown, Ohio

Send me the Welded Steel Pipe Catalog for the Oil and Gas Industries.

Name_____

Title_____

Organization_____

Street_____

City_____ Zone____ State_____

ARMCO DRAINAGE & METAL PRODUCTS

Subsidiary of ARMCO STEEL CORPORATION

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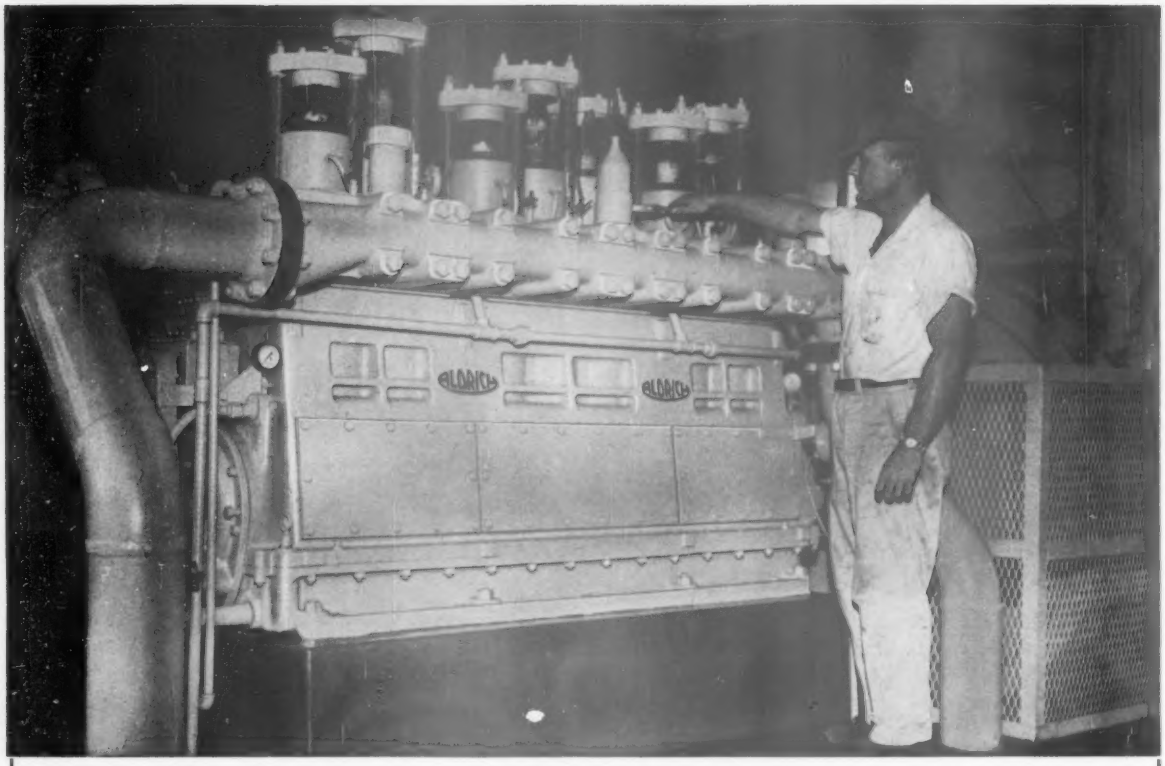


FIELD REPORT

FLOOD: Pegasus Unit

OPERATOR: Mobil Oil Company

PUMPS: Two Aldrich Septuplex

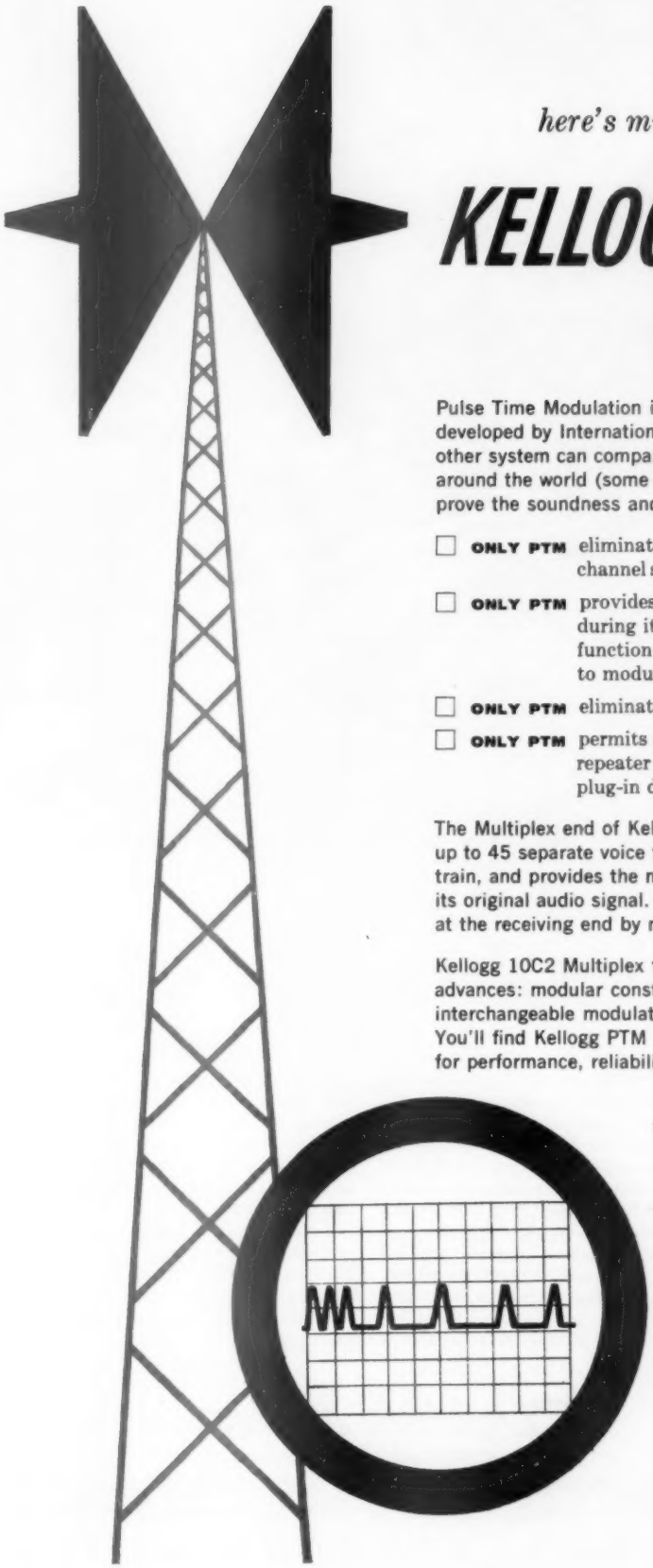
FLOODING STARTED: February, 1955

EXPERIENCE TO DATE:

Pumps continuously deliver brine to two formations — 90 gpm at 2,500 psi; 150 gpm at 1,000 psi. Customer reports: "Routine maintenance only. Aldrich pumps were selected because of previous dependable and economical service under high pressure operations."

Field parts stock available in Carmi, Ill.; Calgary; Casper, Wyoming; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH



here's microwave at its simplest and best!

KELLOGG 10C2 PTM MICROWAVE

Pulse Time Modulation is the foolproof microwave pioneered and developed by International Telephone and Telegraph Corporation. No other system can compare with it in simplicity and reliability. Installations around the world (some dating back to ITT's early systems in the '30's) prove the soundness and reliability of PTM.

- ☐ **ONLY PTM** eliminates complicated tuning or filtering for voice channel separation. All demodulators are interchangeable.
- ☐ **ONLY PTM** provides separate and distinct channels, open only during its own time interval. Therefore S/N is not a function of channel loading; each channel is insensitive to modulation on the other channels.
- ☐ **ONLY PTM** eliminates frequency displacement over the voice channels.
- ☐ **ONLY PTM** permits *any number* of channels to be dropped at a repeater station. Only one additional modulator and one plug-in demodulator are required to drop each channel.

The Multiplex end of Kellogg 10C2 Microwave system can combine up to 45 separate voice frequency channels into a Time-Modulated Pulse train, and provides the means for restoring each of the channels into its original audio signal. Each signal is sorted into its proper channel at the receiving end by means of the distinctive marker pulse it carries.

Kellogg 10C2 Multiplex features the latest and most efficient engineering advances: modular construction, printed circuitry, plug-in channel units, interchangeable modulators and demodulators, and many others. You'll find Kellogg PTM Microwave meets your highest specifications for performance, reliability and engineering design.

Complete technical details will be sent on request. Write to Kellogg's Microwave Division, Box 2725, Raleigh, North Carolina.

KELLOGG
CHICAGO, ILLINOIS
ITT

Kellogg Switchboard and Supply Company, 6650 South Cicero Avenue, Chicago 38, Ill. Communications Division of International Telephone and Telegraph Corporation

7 powerful steps to high octane

Into one end of this big reactor flow refinery streams almost worthless as automotive fuels. Out the other end runs a river that's rich in high-octane alkylate.

Squatting atop the reactor are seven 50-hp LIGHTNIN Mixers. From each one, a turbine-equipped steel shaft reaches down to whip into an emulsion the isobutane feed, the recycle olefins, and the viscous sulfuric acid catalyst.

Mixing is the heart of this process. With the LIGHTNIN Mixers, every cubic inch of each reaction zone gets a violent, steady churning. Controlled turbulence instantly disperses the incoming olefins. It keeps the emulsion homogeneous, prevents separation of hydrocarbon in any part of the reactor, promotes acid economy and light alkylate yield.

At this one refinery, 28 of these big LIGHTNIN Mixers run day in, day out on alkylation reactors. At other refineries, many more LIGHTNIN Mixers handle the same vital mixing job.

To earn this acceptance, MIXCO engineers studied alkylation processes intensively; made detailed model tests of agitation flow patterns in simulated reactor systems; applied specialized knowledge of the correct loading of mixer impellers to operate under varying reactor conditions.

The same mixing technology is ready to work for you when you specify LIGHTNIN Mixers—whether for a new process, for blending 180,000 barrels of product, for keeping sediment off the bottom of crude storage tanks, or for any of the thousand and one jobs LIGHTNIN Mixers do every day in refineries.

Your LIGHTNIN representative can give you quick, competent help on fluid mixing. He's listed in Refinery Catalog and in the yellow pages of your telephone directory. Or write us direct.

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MIXCO fluid mixing specialists

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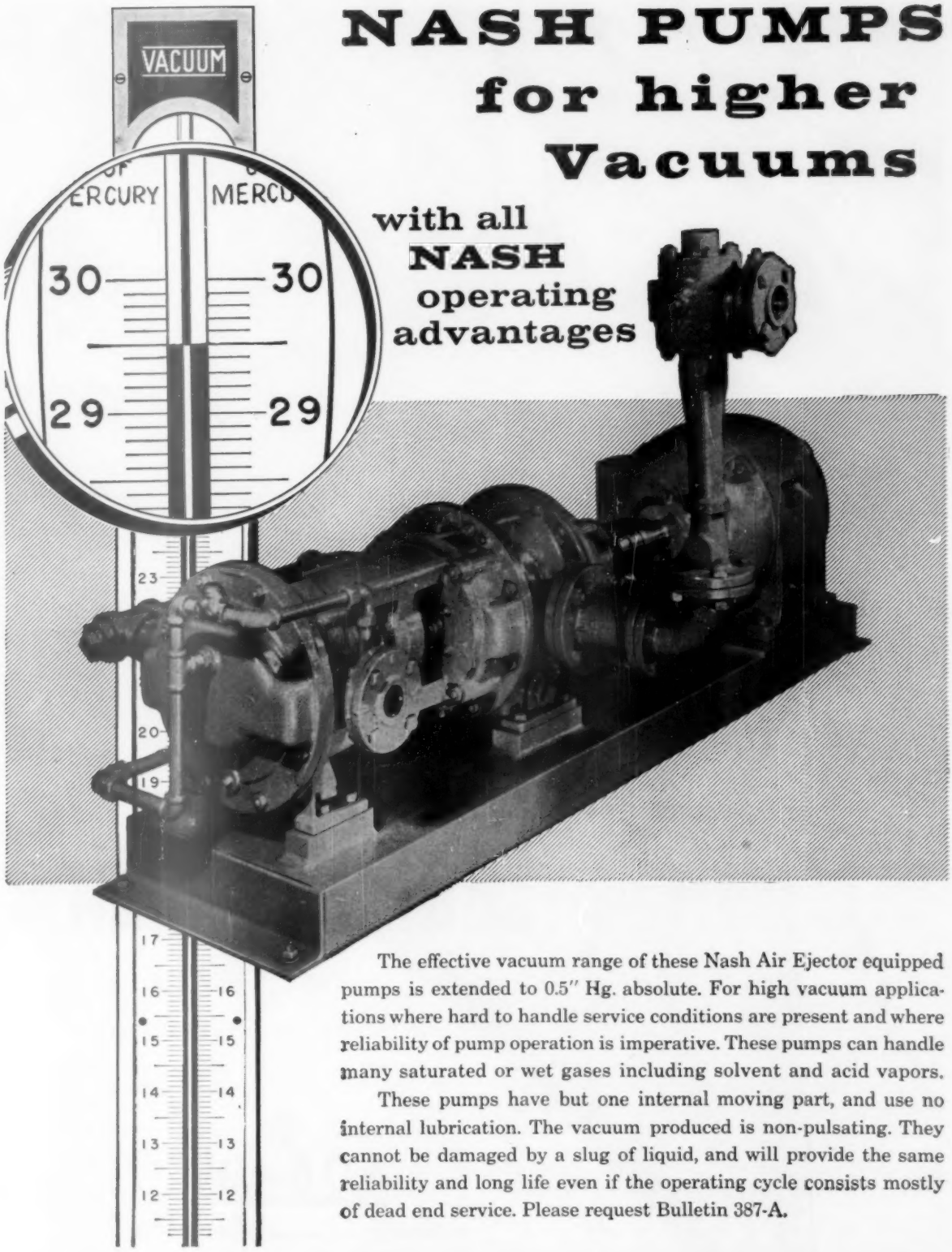
NASH PUMPS for higher Vacuums

with all NASH operating advantages

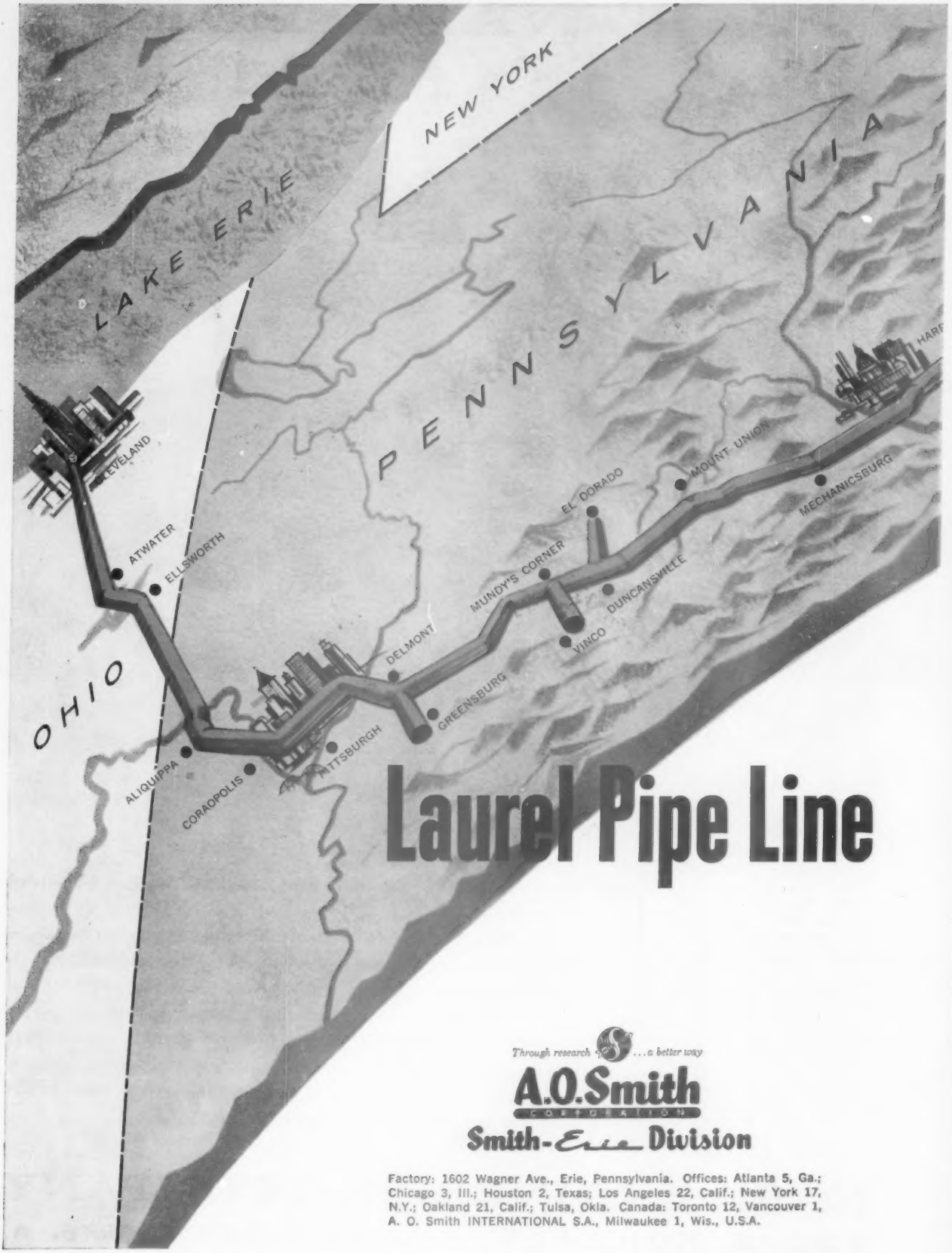


The effective vacuum range of these Nash Air Ejector equipped pumps is extended to 0.5" Hg. absolute. For high vacuum applications where hard to handle service conditions are present and where reliability of pump operation is imperative. These pumps can handle many saturated or wet gases including solvent and acid vapors.

These pumps have but one internal moving part, and use no internal lubrication. The vacuum produced is non-pulsating. They cannot be damaged by a slug of liquid, and will provide the same reliability and long life even if the operating cycle consists mostly of dead end service. Please request Bulletin 387-A.

NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.



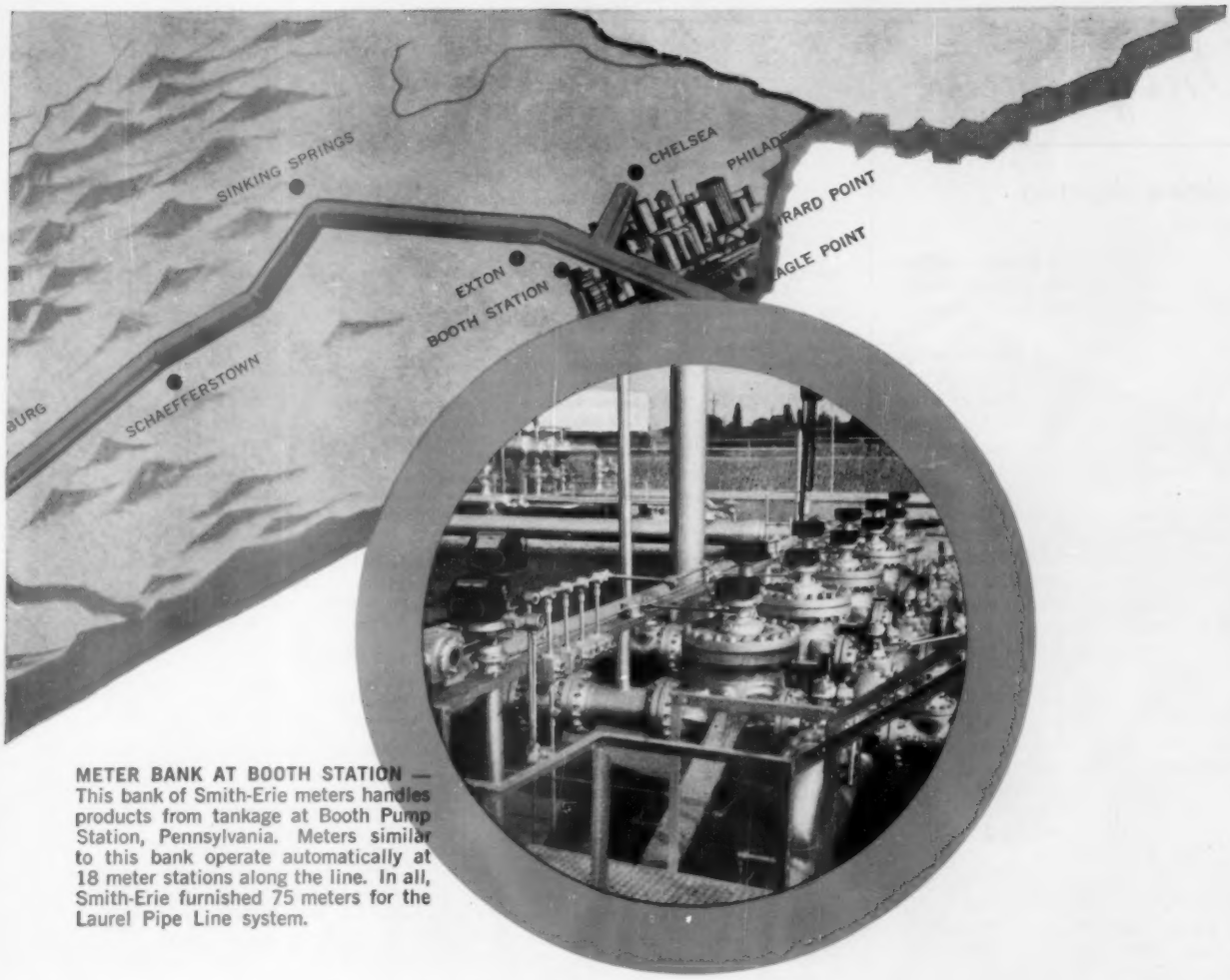
Laurel Pipe Line

Through research ...a better way

A.O.Smith
CORPORATION

Smith-Erie Division

Factory: 1602 Wagner Ave., Erie, Pennsylvania. Offices: Atlanta 5, Ga.; Chicago 3, Ill.; Houston 2, Texas; Los Angeles 22, Calif.; New York 17, N.Y.; Oakland 21, Calif.; Tulsa, Okla. Canada: Toronto 12, Vancouver 1, A. O. Smith INTERNATIONAL S.A., Milwaukee 1, Wis., U.S.A.



METER BANK AT BOOTH STATION — This bank of Smith-Erie meters handles products from tankage at Booth Pump Station, Pennsylvania. Meters similar to this bank operate automatically at 18 meter stations along the line. In all, Smith-Erie furnished 75 meters for the Laurel Pipe Line system.

"autometered" by Smith-Erie

one dispatcher controls flow of 16 grades of products

Flow is automatically controlled all the way from Philadelphia to Cleveland from the Camp Hill office. Sixteen grades of products (everything from burner oil to aviation gasoline) are received into the line from two refineries near Philadelphia, Pennsylvania, and one refinery in New Jersey. Products may be delivered to 18 different metering stations along the Laurel Pipe line.

Smith-Erie "Autometers" are an important part of this highly automatic system. Dispatchers at Camp Hill issue instructions that control both pumpings into the system and deliveries to shippers terminals or other pipeline carriers. For example, the dispatcher, informed that a company is moving 40,000 barrels of kerosene, relays this information to the area deliveryman, then sets this amount on the Smith-Erie set-stop counter and pulls handle. At a predetermined time, dispatcher pushes a button and by remote control opens valve at metering station. Flow continues until the set-stop or the dispatcher terminates the delivery.

Laurel Pipe Line is a working example of how Smith-Erie meters are a valuable asset in automatic operation. For information on how this success can be duplicated for you, contact your A. O. Smith meter man or write direct.

Gulf Oil Corporation, Sinclair Pipe Line Company, and Texaco, Inc., are Laurel Pipe Line Company shareholders.

They Say—

Japanese objection

Dear Sir:

We are regular subscribers to The Oil and Gas Journal and find the articles contained therein informative and interesting.

We occasionally find articles relating to this country and although we do not question their accuracy, the terminology used in the headlines, whether intentionally or not, is sometimes annoying to us.

To cite an example, on page 116 of the March 28 number, there is a headline reading, "Japs to Get into Liquid-Methane Picture." Now, Mr. Editor, I think you can easily imagine how the people here would feel if they find the words "Japs" in a publication which they enjoy and respect for authenticity.

It is hoped that you will be more careful in your wording bearing in mind that your publication is also widely read in this country.

George S. Uyeda
Survey Office
Osaka Gas Co., Ltd.
Osaka, Japan

Editor's note: Our apologies to Mr. Uyeda and our many other Japanese readers. Americans are fond of nicknames—Yanks, for example. But we have no desire to offend oil men—our readers—wherever they are. The word is now stricken from our vocabulary.

Movements, not purchases

Dear Sir:

Your attention is invited to the first paragraph of the article, "Fuel Oil and Jet Top Military Purchases" (OGJ, May 16, p. 118).

The paragraph states "the U. S. military purchased more than half of its petroleum supplies from foreign sources in the last fiscal year," and is attributed to Vice Admiral Roy A. Gano, commander of the Military Sea Transport Service, in his speech before the API tanker conference on May 4.

I attended the conference and heard Admiral Gano's speech and, after a review of the prepared and transcribed speech, fail to find such a statement. The material and statistics quoted in your article and those presented by Admiral Gano represent the liftings by the MSTS and not procurements.

Procurements by the U. S. military

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are not stated above "more than half from foreign sources." The reverse is true; more than half are procured from continental U. S. sources.

This is in no way a criticism of The Oil and Gas Journal but an appeal for more accurate, nonslanted reporting. The Oil and Gas Journal is recognized by this agency as one of the outstanding trade publications in the petroleum field.

O. P. Lattu
Rear Admiral, SC, USN
Executive Director
Military Petroleum Supply Agency

Three zeros dropped

Dear Sir:

I have studied with some interest the article by Israel Putnam on natural gas (OGJ, May 9, p. 180). There is one point, however, that you may be able to clear up for me.

I notice that below the heading on the flow diagram, there is a figure of 13,282.4 M.M.c.f. 100%. Would you please explain whether this is an error or whether I have misread the symbols M.M.

Various sources available to me have suggested that $M = 10^3$ and that $M.M. = 10^6$. If this is so, then the figure in the bracket is equal to 13.2824×10^9 cu. ft., whereas I would have thought that the correct figure should be nearer 13×10^{12} cu. ft. for annual production in the U. S.

E. Keeling
Research and Development Department
Central Electricity Generating Board
London

Editor's note: Reader Keeling is right. Total U. S. natural-gas supply in 1958 was 13.2824 trillion cubic feet (10^{12}). We dropped three zeros.

1895 line of 1953

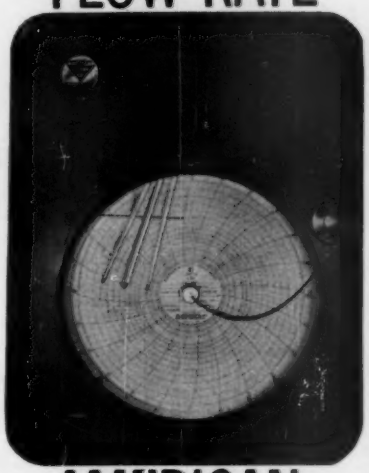
Dear Sir:

Your otherwise excellent article of June 6 on the tidelands decision contains what appears to be an erroneous statement of fact with reference to the Coast Guard line incorporated in Louisiana's Act 33 of 1954.

On page 69 you refer to this line as "a line established by the U. S. Coast Guard in 1895." On page 70 you refer to it as the "old Coast Guard line." On the accompanying map it is referred to as the "Coast Guard line drawn in 1895" and as "1895 Coast Guard line."

It is true that the line was established by the Coast Guard pursuant

PRECISION MEASUREMENT AT ANY FLOW RATE



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Versatile American® Series A-88 mercury-type orifice meters meet the toughest flow measurement requirements – working pressures to 5,000 psi – interchangeable 10, 20, 50, 100 and 200-inch ranges. Recording meters may be equipped with 0-150° F. standard temperature element. Integrating meters integrate static and differential pressure, providing totalized flow indications. Telemetering equipped meters transmit integrated indications to remote locations.

- Manometer body easily cleaned – does not affect calibration.
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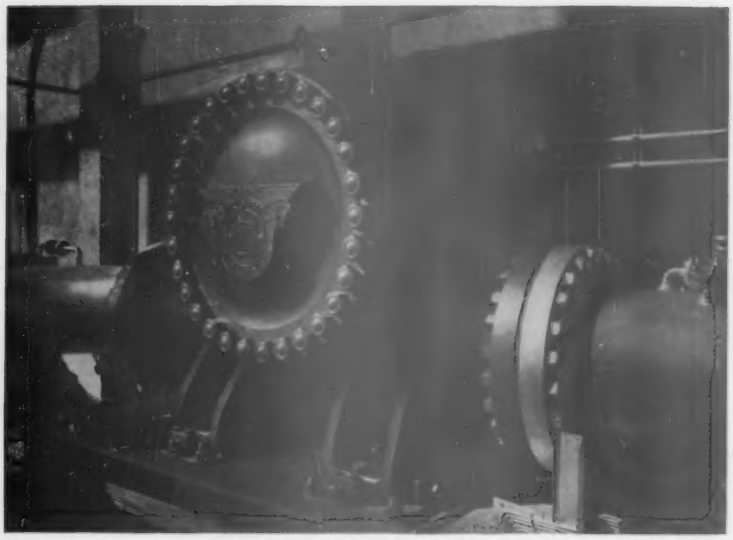

Cooper-Bessemer RFB-24 centrifugals, like this one, powered by Cooper-Bessemer LSV turbocharged gas engines, comprise the world's most efficient pipeline compressor units.

David M. Salls, *Manager, Gas Industry Sales, The Cooper-Bessemer Corporation, explains...*

How 5 Cooper-Bessemer powered, Gulf Interstate engineered stations will give Transwestern peak economy and flexibility

ALL FIVE of the mainline compressor stations of the new Transwestern Pipeline system will be equipped with Cooper-Bessemer engine-driven centrifugal compressors and will be remotely operated. These new automatic, remote-controlled stations will provide unexcelled efficiency and flexibility... a fact proven by the highly successful performance record of this modern equipment in other mainline stations of the same basic design—over 130,000 horsepower to date in mainline service.

The giant Cooper-Bessemer LSV-16 turbocharged gas engines will be of the type shown here. They will drive Cooper-Bessemer RFB-24 centrifugal boosters through speed increasers. Each of the five stations will include two of these high-efficiency compressor units. These units have the highest thermal efficiency obtainable in the gas industry today. The map shows the location of the stations. All units will be automatically controlled from a central point.

We will gladly supply details on this Cooper-

Map shows location of Transwestern's mainline automatic, remote-controlled stations. Background shows type of Cooper-Bessemer LSV-16 turbocharged engines to be used on this new line.

Bessemer equipment, and assist in *your* compressor station plans.

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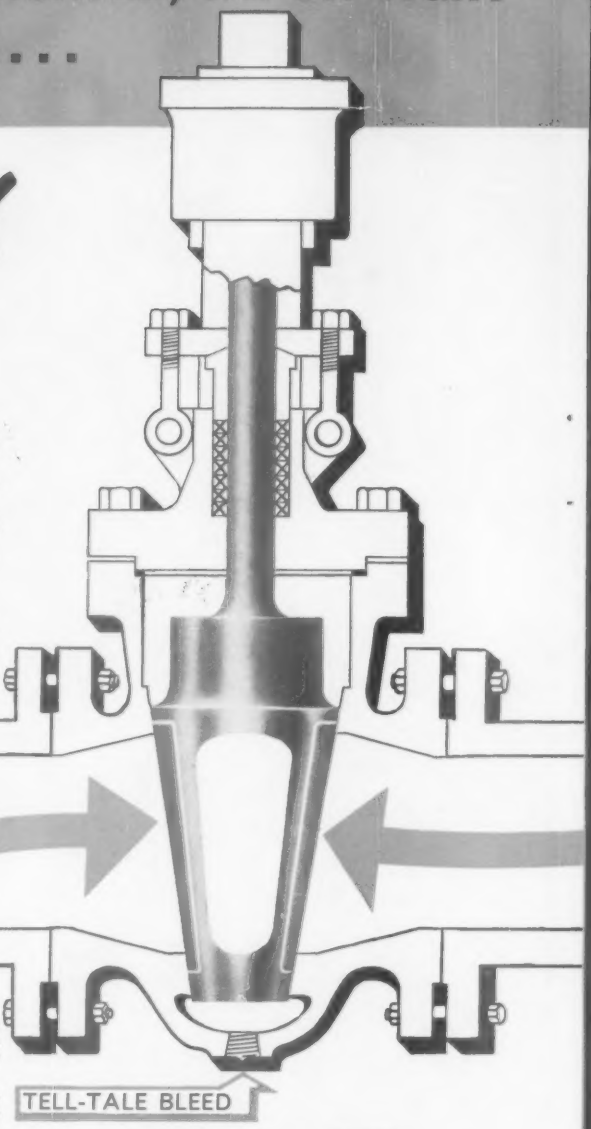
STOCKHAM'S NEW, NON-LUBRICATED, VAPOR-TIGHT WEDGEPLUG "O-SEAL" VALVE . . .

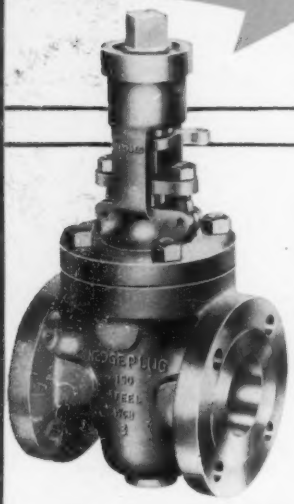
DOES THE WORK OF 2 VALVES!

Provides Double-Block & Bleed in Most Services

Here's the valve you've been waiting for—Stockham's new Wedgeplug* "O-Seal." It not only solves all your leakage problems for good **without lubrication**—but also does the work of 2 valves or a line blind. That's real economy!

The two Teflon# "O" rings in the plug do the trick—give constant vapor-tight shut-off on both the upstream and downstream seats. And the "O-Seal" is **non-lubricated**—cuts maintenance costs **from now on!**





Because of the double pressure-sealing effect of the "O" rings, the upstream seats as well as the downstream seats of this new valve hold "bubble-tight" against line pressure.

The plug in the bottom boss can be pulled to provide the **tell-tale bleed.** In extensive field and laboratory tests, this valve held bottle-tight on the upstream as well as the downstream seats when the bottom plug was removed. There is absolutely no mixing of products in manifolds.

Thus the "O-Seal" can do the job of two ordinary valves or a line blind in most services.

Your Stockham representative will advise you about the recommended services for the "O-Seal's" double-block and bleed feature.

RECOMMENDED USAGES

Stockham's new "O-Seal" is recommended for all general services—air, gas, water, steam, propane, hydrocarbons, etc., as well as for hard-to-hold services. Recommended for temperatures from minus 300° F. to plus 400° F. and not exceeding 720 psi.

Available in carbon and alloy steels, 2"-12" sizes, 150 and 300 lb. pressures. Three port openings—40%, 70%, full round-wrench, handwheel, gear, and motor operated.

OTHER OUTSTANDING ADVANTAGES — Non-Lubricated—no costly maintenance necessary • Absolute shut-off that remains permanently "bubble tight" • Quick, easy operation—won't stick—ever • Double Seating for Double Safety—Ground metal-to-metal seat provides shut-off in case fire burns out "O" rings • No Product Contamination-Protected Seats.

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to a law passed in 1895 (33 U. S. Code 151), but the line itself, so far as disclosed by the Code of Federal Regulations, was first established on December 8, 1953 (C.F.R. 82.95, 18 Federal Register 7893, and C.F.R. 82.103, 18 Federal Register 7894).

The difference between 1895 and December 1953 is of some legal consequence. The Submerged Lands Act, upon which the tidelands decision was based, recognizes only two kinds of state boundaries, first, those which existed when the state became a member of the Union; and second, those approved by Congress prior to May 22, 1953.

It is obvious that the Coast Guard boundary was not established in 1812 when Louisiana became a member of the Union. It is equally obvious that the Coast Guard line could not have been approved by Congress prior to May 22, 1953, since the line did not come into existence until several months after that date.

Lucius M. Lamar
New Orleans

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

JUNE

22-July 1 University of Michigan, engineering summer conference, topics in multiphase flow, Ann Arbor, Mich.

25-29 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.

25-July 5 First International Congress for Automatic Control, Moscow, USSR.

26-28 North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.

26-July 1 American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

27-28 Michigan Gas Association, Mackinac Island, Mich.

JULY

11-20 University of Michigan, engineering summer conference, applied mathematics for chemical and metallurgical engineers, Ann Arbor, Mich.

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur, Springs, W. Va.

AUGUST

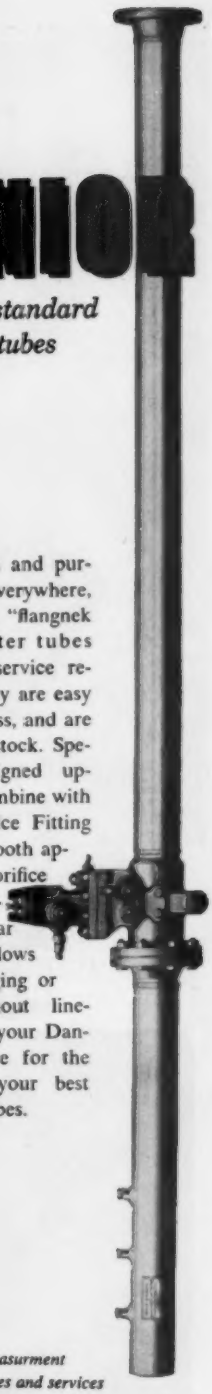
3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-17 American Society of Mechanical En-

SENIOR

flangnek standard meter tubes



Used at sales and purchase stations everywhere, Daniel Senior "flangnek standard" meter tubes meet exacting service requirements. They are easy to order, cost less, and are available from stock. Special, factory-aligned upstream tubes combine with the Senior Orifice Fitting to provide a smooth approach to the orifice plate, free of offsets. The popular Senior fitting allows fast plate changing or inspection without line-shut-down. See your Daniel representative for the full story on your best buy in meter tubes.

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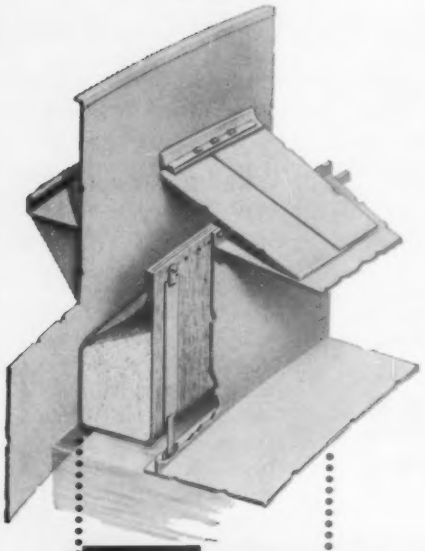
163

FIRST solid cushion seal



When General American developed EverSeal, first solid cushion seal for floating roofs, we wanted a seal that would have these advantages:

1. Simplicity of design, no moving parts, nothing to corrode
2. Permanent, indestructible sealing qualities—no gas or liquid to leak
3. Complete protection of coated tank walls from scuffing or gouging
4. A tough, pliable envelope that would withstand abrasion; ride without damage over projections on the shell
5. Ease of repair or replacement, without taking tank out of service
6. Maximum protection against evaporation loss
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8. No build-up of vapors in the seal area

EverSeal is the *first* solid cushion seal to meet *all* these requirements. It is made of trapezoidal urethane foam cushions enclosed in a tough, scuff-proof envelope of Buna "N" synthetic rubber and polyvinyl chloride plastic.

EverSeal is almost impossible to damage, always provides a safe and complete seal for every floating roof.

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PLATE & WELDING DIVISION GENERAL AMERICAN TRADE MARK

gineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

7-10 Billings Geological Society, annual field trip, Hebgen Lake-Madison Valley area of southwestern Montana.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

16-17 Kansas Geological Society, twenty-fifth annual field conference, northeastern Oklahoma, Western Hills Lodge, Wagoner, Okla.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting,

DARLING VALVES

Photo courtesy of Freeport Sulphur Co. and Sikorsky Aircraft.

90 DARLING VALVES

to help tap new sulphur deposit

Above you see part of Freeport Sulphur's $30,000,000 project to tap a major new sulphur deposit. It's the world's first offshore sulphur mining plant at Grand Isle... seven miles off the coast of Louisiana in the Gulf of Mexico.

Valves on the mile-long "steel island" mining plant were supplied by Darling. They include 2" to 12" OS and Y and 6" to 10" check valves made from Ni-Resist with monel trim ... all for use in corrosive service.

Here's another case where Darling's extensive research and development on corrosion-resistant valves helped solve a specialized operating problem. And on gate valves, Darling's *exclusive revolving double disc parallel seat feature* assures positive sealing and ease of operation at all times.

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Darling OS and Y gate valve with flange ends . . . one of types being supplied for Freeport Sulphur's Grand Isle sulphur mining plant.

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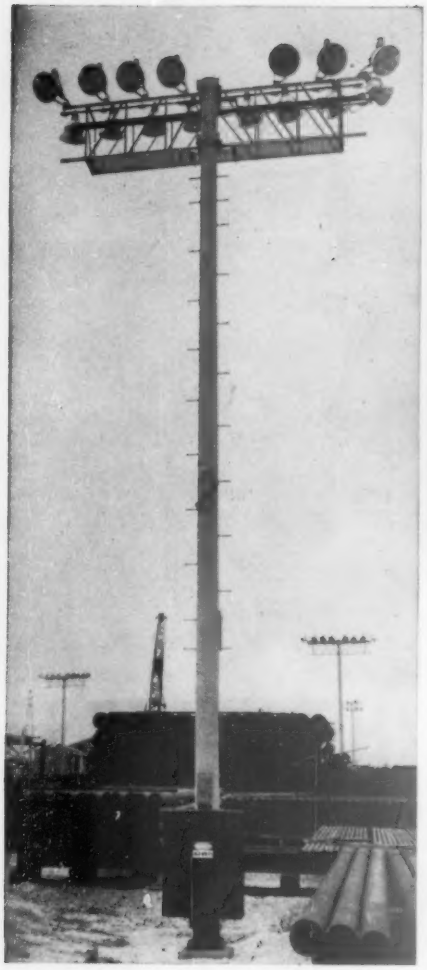
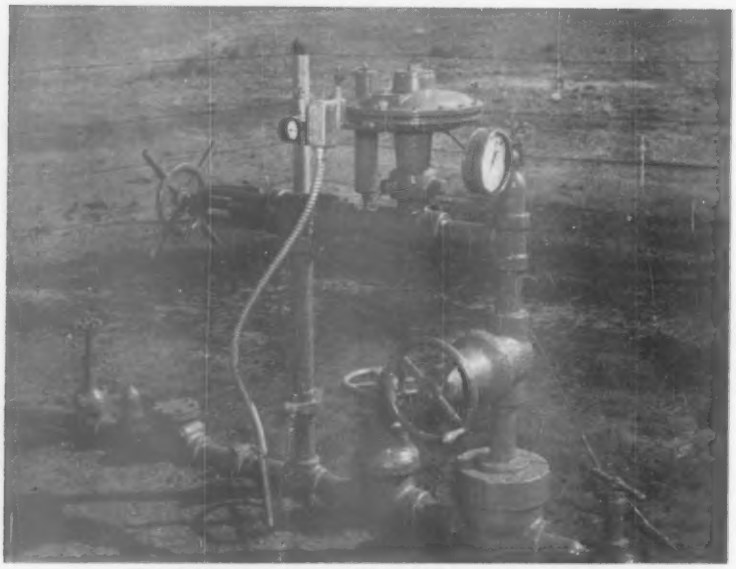
AUXILIARIES





Electrically operated solenoid on flowing well with valve controlled by electric time-clock.

Lighting for oil company pipe storage yards and rail unloading areas.

Typical of thousands of auxiliary applications of purchased electric power... the photographs above indicate the varied use of electricity in the petroleum industry. The dependability and economy of utility electric power is fast proving the answer to many problems in oil producing, transporting and refining. Contact your nearest utility electric power company for full cooperation.

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saves money, manpower,
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you better automatically

Petroleum Electric Power Association

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Coliseum, New York.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Odessa Oil Show, Odessa, Tex.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

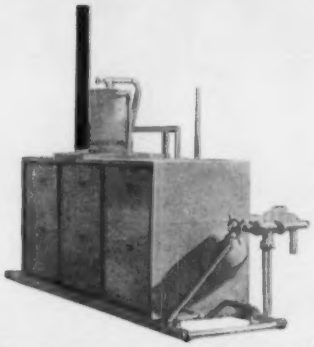
26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

NOVEMBER

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

SAUDER HD-1 UNIDRYER



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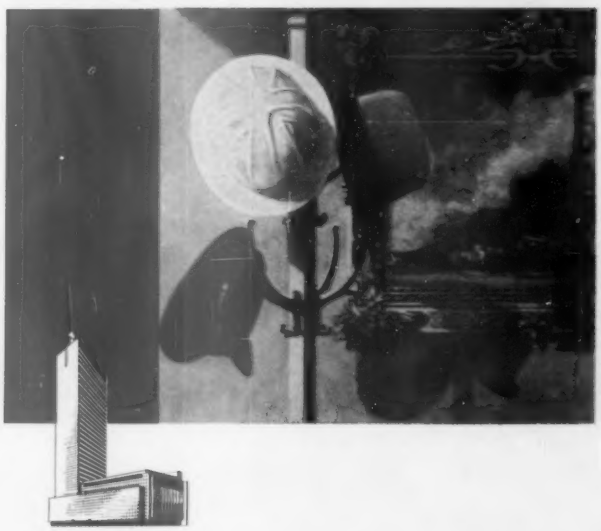

For decades, oil and gas men have turned to the Republic for the many varied and special bank services they require. Republic knows you must have accurate fact and figure data, prompt desisions on financing, and frequently, bank counselling with your lawyer on regulations and tax matters.

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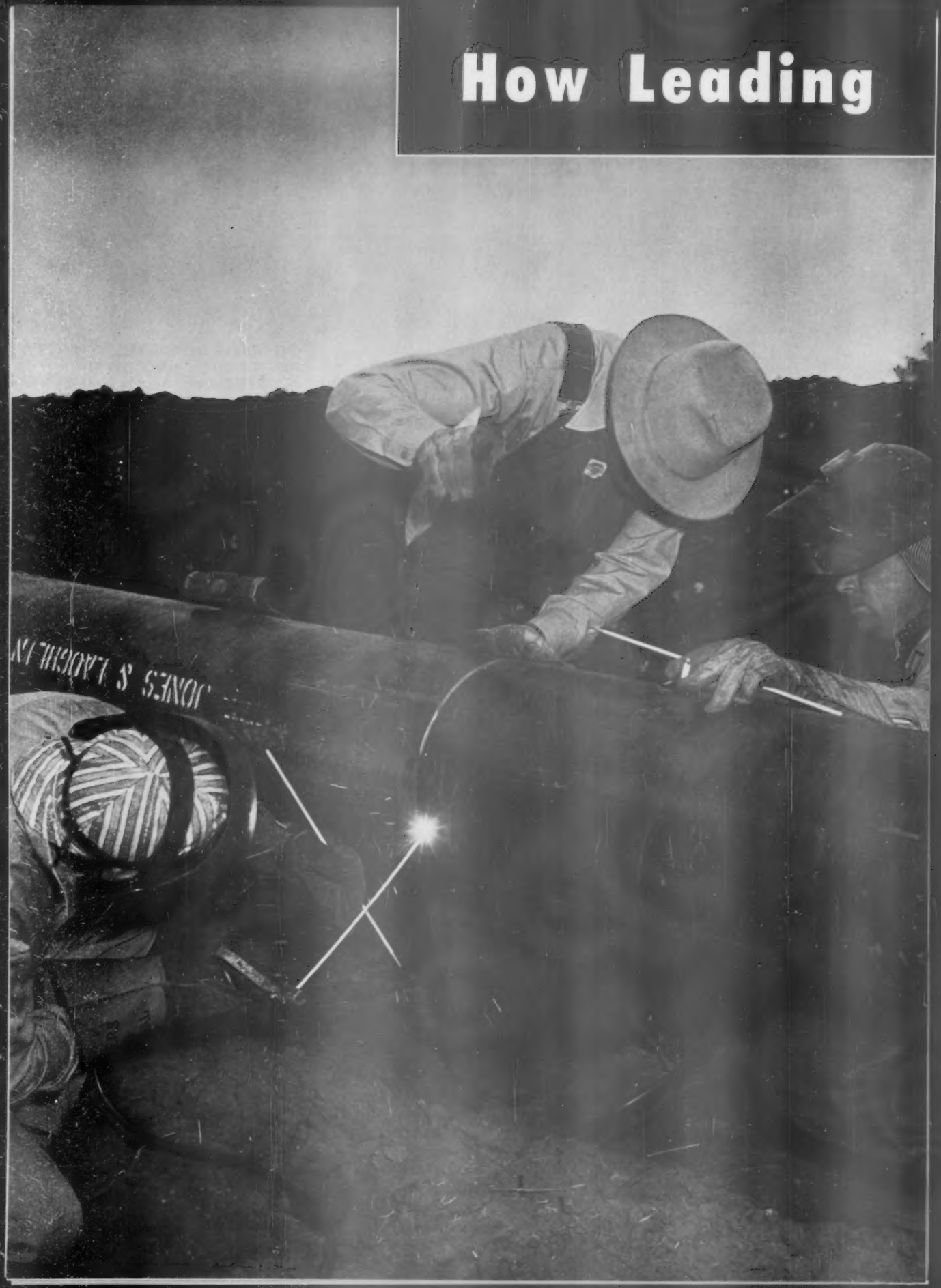
How Leading

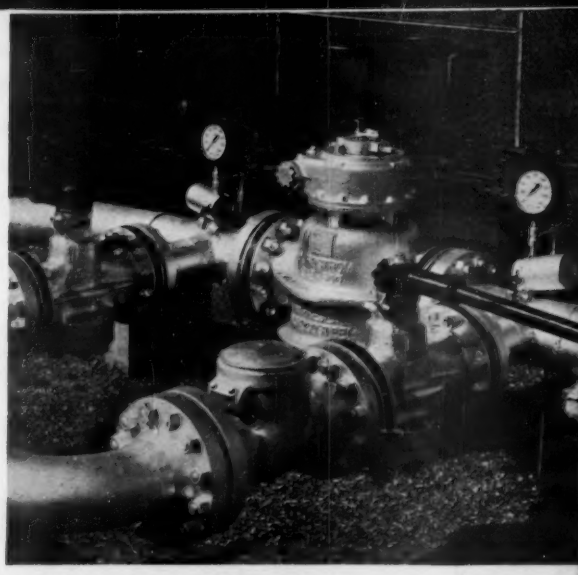


Pipeliners Cut Costs

Leading pipeliners depend on J&L Supply for products with the latest technological advances in design and construction.

J&L pipeline products are specifically engineered for pipeline use. They make lines easier to engineer, install, and maintain. Lower final costs for modern pipelines result from J&L experience, continuing research, constantly improved techniques, and insistence on quality.

Leading pipeliners expect — and get — performance-proved products from their local Jones & Laughlin Supply Store or office.

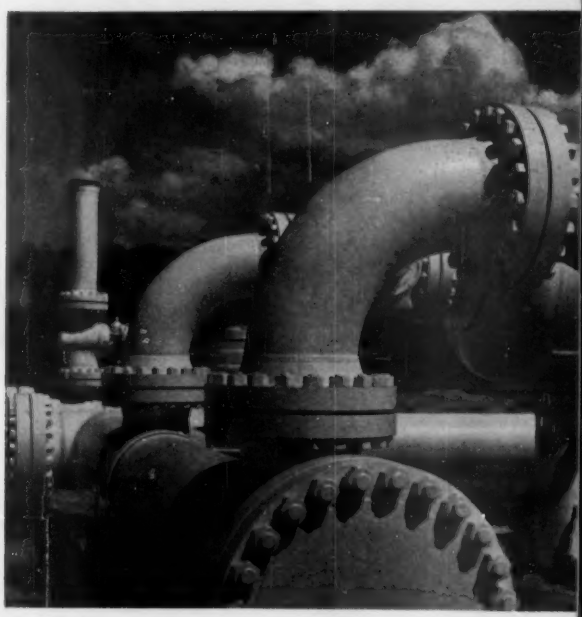


The Sealdport® pressurized lubrication system in Rockwell-Nordstrom plug valves actually repairs itself. The lubricant gives a continuous new seating surface. Under pressure, the lubricant is a powerful seal between the body and the plug. Like self-sealing auto tires, this seal can't be permanently cut, scratched or damaged. Rockwell-Nordstrom plug valves offer dependability and economy. Ask your J&L man for a Rockwell-Nordstrom catalog.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J & L . . . .
It's the best available 106



Taylor Forge welding fittings are backed by years of engineering and research. Here is an outstanding line of standard and special purpose fittings for pipeline use. The photo, taken at a pipeline station, shows the installation of Taylor Forge ells and flanges on first stage gas scrubbers. Your local Jones & Laughlin representative will be glad to give you illustrated literature on these quality welding fittings.

Left, J&L Electricweld Line Pipe's lengths are uniformly round and line up end to end in perfect butt joints with uniform bevels for fast welding. The uniform high ductility of J&L Electricweld assures easier field bending. Descriptive literature is available from your local J&L man.

New design Series 301 Tubing can cut your cost per well up to 30%

Savings: In a typical dual completion, using parallel strings of 1½" tubing to 6000 feet, Tex-Tube Series 301 Tubing saves you approximately $2,400 over the cost of non-upset. Savings of up to 30% can also be made with Tex-Tube 2-1/16" and Tex-Tube 2-3/8".

Setting depths to 12,200 feet, depending on size and grade.

Clearances equivalent to premium priced joints.

Standard 10-Rd API threads, interchangeable with applicable upset and non-upset sizes.

Before you buy another string of tubing, contact the man from Tex-Tube in your area, or write us.

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JOURNALLY SPEAKING

50 years ago

June 30, 1910

The city of Shreveport acts to obtain land in nearby prolific Caddo field on which to drill gas wells. Move follows adoption of plans to supply new industries free fuel for a period of 10 years, with a charge of only 3 cents per M.c.f. thereafter. Competent experts claim the supply of gas in the area is inexhaustible.

One of the worst fires on the Gulf Coast in several years swept the tank farm at The Texas Co.'s Port Arthur refinery during the severe electrical storm last week. The fire, caused by lightning, destroyed nine tanks of various sizes containing crude oil and distillate. Gulf Pipe Line Co. lost one 55,000-bbl. tank of crude at its El Vista tank farm.

25 years ago

June 27, 1935

Texas Supreme Court decision in famous Brown vs. Humble Oil & Refining Co. Rule 37 well-spacing case recognizes correlative rights of oil in place regardless of ownership, and that law of capture is subject to state regulation. Ruling expected to bolster administration of conservation laws.

Forest Oil Corp., largest oil producer in Bradford, Pa., field and leader in the science of flooding operations in that field, makes Oklahoma debut with purchase from Warner & Caldwell of 4,000 to 5,000 acres of old productive leases with several hundred wells in Coody's Bluff area in Nowata County.

A. I. Levorsen, recently elected president of American Association of Petroleum Geologists, resigns from position of chief geologist of Tide Water Oil Co. at Houston and will devote his time to personal business.

10 years ago

June 29, 1950

Federal Power Commission approves Texas Illinois Natural Gas Pipeline Co.'s proposed 1,330-mile 26 and 30-in. gas line from lower Gulf Coast to Chicago.

U. S. State Department abrogates Mexican reciprocal trade agreement. Action will restore oil-quota provisions of old Venezuelan agreement with higher import tax restrictions. It is considered administration's answer to demand it do something about the oil-import situation.

Royal Dutch Petroleum Co., copurent with Shell Transport & Trading Co., Ltd., of the Royal Dutch-Shell group of companies, celebrates its sixtieth birthday anniversary. Dutch government and industry officials join in elaborate ceremonies at The Hague in the Netherlands.

The Changing Scene

LAST WEEK Max Batchelder pinch-hit for Neil Williams in filling the left-hand column of this page and he got so intrigued with the job that he kept right on going and filled our part of it, too.

What Max said about people's thinking not changing in 50 years intrigued us, so we, too, dug out that 1910 bound volume of the Journal and discovered that he was right.

Some of the Journal's 1910 editorials would, as Max said, make a person think he had picked up the 1960 volume by mistake.

Not the language. Mercy, no! As Max said, "they don't write like that any more." Journalistic style has changed in 50 years, but the oil industry's problems and the Journal's reaction to them have hardly changed at all.

For instance, there's the subject of industry unity and the way in which one segment of the industry makes public attacks on others. The Journal said:

"It is quite apparent that there is a lamentable lack of cohesive cooperation between the allied branches of the industry when serious problems force themselves for solution. Even the imaginary lines that divide states, and in some instances counties, become firing lines that bring many cripples to the hospitals of public sentiment, leaving scars that mar. Must we admit that vulgar selfishness prompts these unseemly disturbances?"

Then there was the new (?) problem of public relations and the ridiculous statements made in the popular press:

"The way some people write about the oil business sets one's false teeth on edge. A wise gazabo named Harold Whiting Slauson consumes valuable space in the Saturday Evening Post to air his knowledge of petroleum. To illustrate, in a word, just how much his stuff is worth it is only necessary to give one sentence: 'Petroleum has been found 26,000 ft. below the surface of the earth.'—In a lantern, probably."

It seems there was a little problem of overproduction and weak markets then, too. Here's a quote from a 1910 editorial that is just as appropriate for 1960:

"What is needed right now is markets. Hundreds of persons have entered the producers' ranks and started to drilling, thoroughly convinced that markets are already established, and that all they have to do is sign up and their oil will be taken care of. The fact is we are in a very ticklish position in the marketing end. Production has got so far in the lead that it will require a long, hard pull to adjust matters."

There wasn't any Federal Power Commission 50 years ago, but politicians were wooing consumers' votes by campaigning against the high prices producers charged for natural gas. For instance, the mayor of Shreveport was campaigning for reelection on the promise that the city would drill its own wells in Caddo field if the producers there charged more than 1½ cents per M.c.f.

Independent jobbers were demanding disintegration and attacking refiners for direct marketing. The Journal cautioned against this attitude, saying:

"Being essentially a middleman, the marketer must, to succeed, be on friendly terms with both sides, although there is now and then an individual who believes that he can call all his neighbors chicken thieves and continue to borrow eggs from them."

All during 1910 the price of crude oil kept falling, and producers in California, Oklahoma, and elsewhere called it a plot of the majors, demanded government investigations, threatened boycotts, and organized their own marketing companies.

And the Journal pointed out editorially that there was a world surplus of oil, demand had risen 10% in 4 years while production was up 32%, there was so much new foreign production that world markets were demoralized, stocks of crude and products were grossly excessive, and prices of refined products were the lowest in years.

Sound familiar? That was all in 1910. As the philosopher observed, "the more things change, the more they remain the same."

—Henry D. Ralph.

MOST RESPECTED PACKER

It's known the world over for sheer downright dependability

BAKER RETAINER
PRODUCTION PACKER
PRODUCT 415-D

This great packer has many applications—it's as versatile as it is dependable. It's a single-string production packer that comes in many sizes and bores. Moreover, it is surrounded by a family of accessories that transform it into a dual or triple packer—or into a temporary or permanent bridge plug or squeeze tool. Its formidable pressure-holding capacity makes it in many ways one of the finest of all squeeze packers.

It is set on a wire line—or on tubing or drill pipe. Baker's fast new milling tool mills one out in two to four hours—a fourth the time it once took.

For the latest practical knowledge of how to use Baker Retainer Production Packers, call your Baker Representative.

THE DOUBTS that harass well operators got a real body blow when the now-celebrated Baker Retainer Production Packer was developed some years ago.

This is probably the most predictable (and certainly the most respected) packer ever to go into an oil well. It commands the respect and confidence of operators the world over.

WHAT'S THE SECRET of building a packer so tough and reliable you know it will keep you honest when you recommend it?

For one thing, it takes time—years of performance studies. We've sweated out failures and assessed our successes—sifted out weak points and strengthened the strong points.

This great packer is at work right now in tens of thousands of wells—the average wells, the corrosive wells, the deep, hot, high pressure wells.

THAT'S A TOUGH proving ground—one that has helped us soak up a vast knowledge of what happens to slips, packing elements, and the like, when a packer is downhole. We've got the facts.

Baker made the first retainer packer—for many years the *only* retainer-type packer. The result is a wealth of packer experience that's hard to equal.

This remarkable packer shows it. Over the years we've refined it into a tool that has unyielding stamina. That's why we can call it the most predictable packer of them all.

BAKER

RETAINER PRODUCTION PACKER

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When the need for proration hits home

ADVOCATES of more widespread proration are barking up the wrong tree. They have a fat chance of getting many states to adopt market-demand proration just to help Texas, or to comply with some formula defining their "fair share" of the U. S. market.

They will get further if they will explain to the nonprorating states that it is to their own local advantage to stabilize their market and apportion it equitably among their own producers.

They could use Illinois as an example.

ILLINOIS SAYS it doesn't need proration because the state produces less oil than it consumes. This ignores the fact that Illinois is not insulated from the national market.

When purchasers cut the price of Illinois crude recently they explained that the total volume of crude available from both local and distant sources was greater than the market needs of refineries in the area.

Because it has no proration machinery to lessen the surplus, Illinois has decided, in effect, that the best thing for its industry is to produce at the maximum on a glutted market with falling prices and to let each producer get as big a piece of the market as he can capture.

This is a wise course for Illinois if all of its producers have costs low enough to yield a profit while underselling all competitors.

But if in Illinois wells are prematurely abandoned as uneconomic, new development becomes unprofitable, and producers are not sharing the market equitably, then the state might see some advantage to itself in lopping off a part of the total oversupply in its market and in dividing that market in a way that will benefit its local industry as a whole.

For proration is not just a tool to help curb oversupply. It is an integral part of a conservation program. Without some sort of proration based on the demand for crude a state cannot properly protect correlative rights, provide ratable take, or achieve the other objectives of conservation.

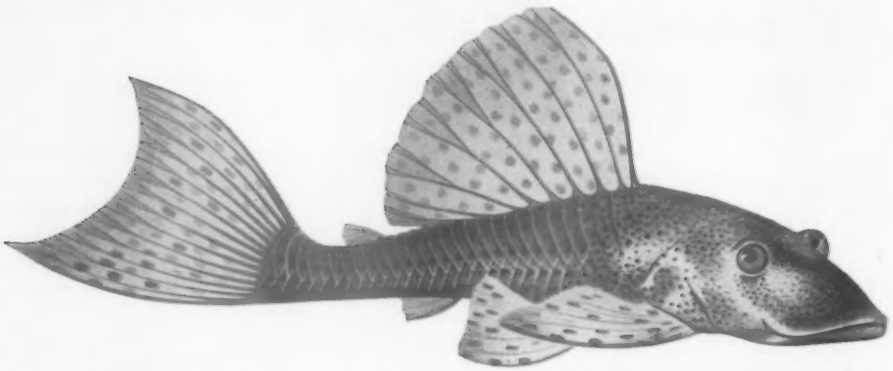
THIS WAS LEARNED the hard way by a few states during the national crude surplus of the 1930's. It will be learned by the others when they have suffered as severely from the present surplus—unless they heed the experience of the states that do prorate.

Rocky Mountain states say they don't want proration because they are small producers and remote from markets. Eastern states say they don't want it because they are small producers and close to markets.

They will want proration when they realize that no market is purely local, that the total surplus is too great for three or four prorating states to curb, and that their local producing industries will suffer by a continuation of the losses and inequities of a glutted market.

Missionary work is needed in that field—rather than talk about any state's "fair share" of the national market.

To identify a strange fish...



you call in an *ICHTHYOLOGIST*

(specialist in fish life)

to weld a pipe line...

call in *LINCOLN*

(specialists in arc welding)

WHETHER you're laying a 30" line from the Four Corners to 'Frisco or a 24 incher from Port Arthur to Pensacola, the thing you need least is maintenance problems. Specially on welding equipment with the stringer head crew setting the pace for all other crews and hundreds of thousands of dollars of equipment following at that pace, you'd better have welders that will stand the gaff.

That's why along pipelines the world over, where the going is toughest, you'll find battered, mud-splattered LINCOLN engine-driven welders stringing pipe by the mile. Year after year, LINCOLN sells more engine-driven welders than all the rest of the industry combined — and for just one reason: dependable performance for longer periods with less maintenance.

LINCOLN Field Engineers are specialists in welding techniques and application. They're backed up by LINCOLN Electric Company, the world's leading specialist in arc welding. Take advantage of this experience. Call in the Field Engineers on your problems or write for Bulletin 4301.1 today.

To learn how LINCOLN can be of service to you, write today

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RAILROAD COMMISSION gets a variety of proration views from a big audience of oil representatives as . . .

Texas Weighs Stripper Flood Curbs

• Opinions vary, but it's a good bet that Commission will come up with some mild restrictions to help slow increasing flow of nonprorated crude oil.

THE REGULATORY eyes of all prorating states will focus sharply on Texas in the coming weeks to see what that state does about a basic and growing market-demand question.

A decision now hangs in the balance in the nation's biggest oil state as to future allowable treatment for secondary-recovery projects.

Can such projects be prorated? Are they getting more than their share of the present pinched market for crude? If the answer to both questions is yes, how far can future projects be cut back without removing the economic incentives which lead to secondary operations?

The answers are important because:

. . . **Producing capacity** in Texas and elsewhere is still growing faster than the available market for the oil.

Allowables for prorated wells are already discouragingly low—so low in Texas that one major has concluded that it cannot achieve a reasonable payout on a well at any depth unless it is a multiple completion. And the pinch may get worse before it gets better. Exploration activity, always a good barometer, is down and shows no sign of any large pickup.

. . . **Secondary production** from injection projects is climbing rapidly. And it is generally predicted that this climb will continue. Pan American Petroleum Corp. predicted at the last World Petroleum Congress that the percentage of total U. S. output taken by secondary oil would increase from a present estimated 18% to 50% by 1980.

Regulatory commissions are concerned about how to reconcile these two factors. Their big problem lies in giving sufficient incentive to secondary projects but not so much as to further discourage exploration.

Hearings draw crowd . . Last week the Texas Railroad Commission began poring over a mountain of technical testimony in its effort to weigh the impact of Texas secondary oil and decide what should be done about it. The pile of data, perhaps the largest ever submitted at one time, was collected during two solid days of hearings June 16-17 before the commission in Austin.

A large group of independents and representatives of nearly every major company operating in Texas jammed the ballroom of the Commodore Perry Hotel. And the crowd, estimated at some 400 to 500, stayed until the last shot was fired.

Along with the flood question, the commission will also ponder whether to adopt its 1947 depth yardstick as a maximum allowable and, in corollary action, to cut back to this level fields without existing higher MER's.

There is no good indication yet as to when the Texas oil-regulatory body will rule. Operators may file statements and briefs in the matter, however, until July 1. And the commission is not expected to decide the issues until sometime after this added testimony is received and digested.

Flood proration ahead? . . . Bulk of the 2-days' testimony was ad-

Texas' Top Ten Excess Producing Fields

(Fields receiving largest MER allowable in excess of 1947 yardstick)

	1947 Yardstick	Well MER	1947 Yardstick (field)	MER (field)	Excess allowable
Hawkins	73	186	35,218	86,980	51,762
Webster	91	306	15,051	55,060	40,009
Hastings, W.	72	134	32,388	59,820	27,432
Thompson	82	309	12,185	36,049	23,864
Van (20 Ac. units)	55	531	21,406	45,011	23,605
Yates (100 Ac. units)	117	1,620	30,527	50,019	19,492
McElroy (reduction on 20 Ac. wells)	55	79	57,877	75,550	17,673
Andector Ellen	142	250	15,402	26,912	11,510
Oyster Bayou	133	400	6,189	17,542	11,353
Sand Hills McKnight	64	185	18,776	26,442	7,666
TOTAL	...	...	245,019	479,385	234,366

dressed to the question of whether Texas should join a growing list of prorating states which have moved to place some restriction on waterflood production. (OGJ, June 13, p. 70.)

There was general agreement that lease or unit allowables should be a part of any new set of rules governing future projects.

But operators split widely as to how much allowable incentive the artificial drives should have.

How they stand . . . Humble Oil & Refining Co., as expected, proposed the most stringent restriction.

The Texas Conservation Group, an organization of a claimed 150 individuals and companies, some of them majors, likewise surprised no one in pushing for what amounted to be the least curtailment of stripper operations.

This group was organized specifically to study and submit recommendations at the hearing. Major company members included Sunray Mid-Continent Oil Co., Sinclair Oil & Gas Co., Phillips Petroleum Co., and Sohio Petroleum Co., and others.

Taking a similar stand were the West Central and the North Texas oil and gas associations.

Generally in between the two extremes were other major operators who put on individual testimony.

The Humble plan . . . Humble spokesmen pointed to what they termed ominous trends in production statistics in Texas and the U. S. generally as affected by waterfloods.

W. J. Greenwald, chief reservoir engineer for Humble, called attention to figures compiled by the Interstate Oil Compact Commission which showed stripper-flood output climbing from 100,000 bbl. daily in 1950 to over 600,000 bbl. daily in 1958.

The same source, he said, shows oil output from gas-injection and pressure-maintenance projects climbing from essentially zero in the early 1940's to more than 750,000 bbl. in 1958—not including East Texas fields.

Texas stripper floods alone, Greenwald said, have multiplied to the point they were producing about 50,000,000 bbl. per year in 1958.

Curves plotted on these trends, showing output from such projects, go almost straight up since the middle 1950's with no sign of leveling off, he said. Humble, he said, foresees a great ascent in Texas flood output in the future which would seriously injure primary wells unless the lid is clamped on.

Humble witnesses testified that exhaustive study had led them to believe that there is no difference in the physical displacement of oil from a reservoir rock via a stripper flood, a pressure-maintenance flood, or a natural water drive. Rate of injection, it argued, has no effect on ultimate recovery. And Humble can see no physical basis for differences in allowable treatment between stripper floods and pressure-maintenance projects.

Humble feels, Greenwald said, that operators have incentive enough to start injection projects from the added reserves and the immediate boost in production that result.

He said the company was prepared to support a change in the Texas system, however, which would grant a unit or lease allowable for a project, with the input wells to get allowable, but with the project subject to shutdown days.

Others disagree . . . The Texas Conservation Group objected heatedly to Humble's contention that rate has no effect on ultimate recovery—especially in a stripper flood.

W. O. Keller, of Keller & Peterson, Fort Worth engineers representing the group, argued that there are fundamental differences between pressure-maintenance operations and the pattern-type stripper floods.

An operator, he argued, usually has four water fronts advancing toward each producing well in a pattern flood. He doesn't know where the water fronts are at any given time until breakthrough, and then doesn't know from which direction the water came. The best assurance the operator has that oil will not bypass the producing well, he said, is to keep the pressure in that well low by producing at capacity.

The TCG found fault also with Humble's expressed alarm over the growth of flood production. Keller said commission statistics show that stripper floods in Texas now are producing only 186,000 bbl. a day—and that only 37,000 bbl. daily of this amount is over and above the 1947 yardstick. This, he said, amounts to only 2.3 bbl. per day per well in the stripper-flood group.

Stripper wells in Texas, Keller argued, now are averaging only 11.4 bbl. per day, while the statewide average of all wells is 13.3 bbl. per day.

The TCG suggested a proration plan for both stripper floods and pressure-maintenance projects which would give incentive allowable based on a fluid production-injection ratio. The plan provides an injection index to determine the amount of the incentive. It would give added allowable to any project injecting more fluid than it produced—the higher the over-injection, the bigger the bonus allowable.

The plan, Keller said, would still permit most floods to produce at capacity but would restrict the few which prove to be unusually prolific.

Admittedly, this plan would give a much larger bonus allowable to a stripper flood than to a pressure-maintenance operation.

Reserves formula boosted . . . The most-pronounced departure from the current methods, however, was the formula backed by Atlantic Refining Co.

Atlantic proposed a plan whereby allowable would be distributed to a project in direct proportion to the added reserves it made recoverable.

It would apply equally to all types of artificial drives—stripper floods, pressure-maintenance operations, miscible drives, or gas injection. Roughly, it would give 500 bbl. of added allowable for each 1,000,000 bbl. of reserves added to field recovery by an injection project.

Such a plan, Atlantic contends,

would have the highly desirable result of inducing an operator to start a project at the best possible time to recover the most oil and also to use the best possible method.

The operator, the company argued, would not be tempted to wait several years for a field to reach the stripper stage because he then could get more favorable allowable treatment.

Industry experience in Alberta and Arizona, Atlantic contends, has shown that a reserves plan is now workable and is the fairest way of prorating.

The amount of the suggested bonus, it said, would approximate the current Texas ratio of production to reserves.

Segmental production . . . Several operators, including Cities Service, Phillips, and British American Oil Producing Co. proposed flood treatment similar to that in several large Oklahoma fields.

Here, the operator develops the total project in stages so that the stimulated wells produce at capacity while the project as a whole does not exceed a preset oil production rate.

Phillips' Jack Turner told the commission he felt that the various contestants at the hearing were not nearly so far apart as might appear. Nearly all, he pointed out, are in favor of unit or lease allowables.

High MER's attacked . . . In the second important phase of the hearing, attorneys for Socony Mobil Oil Co., Texaco, and others leveled heavy fire at a minority of Texas pools producing under high MER's.

Mobil's Jack Vickrey pointed out to the commission that the high MER's were granted years ago when demand was high in proportion to oil supply. Now, he said, prolific new fields are restricted to the 1947 yardstick while these older fields go right on producing far more.

Mobil and Texaco asked that the commission restrict allowables of the high-MER fields to no more than the yardstick value for their depth and spacing.

Vickrey pointed out that the commission already had precedent for such action in that it had reduced the high-MER fields to yardstick rates once before in 1950 when demand was tight. He said the current situation is much worse than in 1950.

Cutting back the high MER'S, Mobil argued, would permit the commission to give every prorated well in the state an additional producing day each month—or 12 more producing days per year.

Evidence presented by Mobil showed that there are now 153 fields in Texas with MER's in excess of the 1947 yardstick. This is 2.2% of the 6,906 fields in the state.

These fields, Mobil claims, now have 16% of the state's total schedule allowable. And they have a total of 336,686 bbl. of allowable per producing day over the yardstick.

Mobil named 10 fields as having more than 70% of this total excess over yardstick with 234,366 bbl. per producing day (See table).

Battle of pocketbooks . . . Cross examination of Humble witnesses by Lawrence Jack Moore, Texaco attorney, brought admission that Humble has 107,000 bbl. of allowable per schedule day in MER fields over yardstick.

This, the Humble engineers said, translates into about 28,533 bbl. of allowable per calendar day over yardstick, of which a little over 20,000 bbl. daily is actually produced.

Moore also drew out that Humble is not a large operator of stripper floods in Texas—with average production of about 5,500 bbl. daily out of a total of 220,000 bbl. daily it produces in the state.

A statistical study of Texas production run by another organization, on the other hand, shows that Mobil, Sinclair, Texaco, and others have little stake in the high MER fields but have relatively large production from injection projects.

Along with Humble, Pure Oil Co. and Pan American Petroleum Corp. have large holdings with high MER's.

What's to come . . . Few are bold enough to predict just how the commission will rule on either the flood or the MER issues.

It is virtually certain that it will not decide either until after July 1 when the rest of the written testimony is due in Austin.

Those who do stick their necks out appear to feel generally that the commission may adopt some form of mild restriction on stripper floods.

Some feel it likely that the Texas body will act also to remove the present confusion as to what is a stripper flood and what is a pressure-maintenance project. The "gray" area in between wherein a project is not clearly either one has been a cause of concern to the commission.

William J. Murray, Jr., commission member expressed concern repeatedly during the hearing on this score and probed steadily for operators' recommendations.

More Water Floods Coming

• Even as the Railroad Commission pondered proposed restrictions, three new projects were being scheduled.

TEXAS operators last week prepared to launch three more big water floods taking in a total of more than 35,000 acres of West Texas production.

The projects will add many millions of barrels of oil to ultimate recovery from Goldsmith 5,600-ft. field in Ector County, Means and Nolley Queen sand pool in Andrews County, and Cedar Lake field in Gaines County.

The Goldsmith flood will be kicked off soon by Gulf Oil Corp. in the upper Clearfork under its C. A. Goldsmith et al. lease. It will take in 15,200 of the field's 30,000 acres.

The project will involve 372 producing wells and will expand an existing pilot operation started in December 1956.

The Means flood . . . To the north, Humble Oil & Refining Co. and 11 other operators are nearing target date for first injection in a cooperative flood in the Queen sand under 13,700 acres of the Means-Nolley Queen sand field.

The area is about 85% depleted, with cumulative production since discovery in 1954 of more than 7,000,000 bbl.

Humble estimates that the oil added by the flood will at least equal primary recovery.

Project area now has 178 wells averaging about 15½ bbl. daily each.

Cedar Lake project . . . A flood planned by Pan American Petroleum Corp. in the San Andres under about 7,000 acres in Cedar Lake field likewise will add "millions of barrels of additional oil."

This project, too, will involve expansion of an existing "exceedingly successful" pilot flood.

Cedar Lake now has 175 wells and has produced a total of more than 21,000,000 bbl. of oil. The major portion of the field is unitized.

Courts Split on Small Tracts

- **First, lower courts made opposite rulings in "trespass" suits; now two higher court reversals cancel each other.**

TEXAS COURTS are having all kinds of trouble trying to decide whether the laws of trespass come into play when a well is fractured across lease lines.

Last week, for the second time in 6 months, two state courts came up with diametrically opposite rulings in separate cases involving tiny-tract wells in McAllen-Pharr gas field in South Texas.

Late last year district courts in Hidalgo and Hays counties ruled oppositely in almost identical cases filed by Delhi-Taylor Oil Corp. and Mayfair Minerals, Inc.

These operators had asked the courts to halt fracturing operations by independents on pint-sized town lots adjoining the Delhi-Mayfair acreage in the city of Pharr. They alleged that fractures would extend under their leases and thus constitute illegal trespass.

The Hidalgo court agreed and issued an injunction. The Hays court said no—that the matter was one for the Texas Railroad Commission, not the courts, to handle.

Both cases were appealed.

Now, appeals courts in Austin and San Antonio are equally confused. Each appeals court overturned and reversed the finding of the district court.

So the muddle is as muddled as ever.

The Hays County court was ordered by the appeals court in Austin to set for trial on the merits a case involving three wells drilled by A. W. Gregg. The appeals court ruled that the trial court erred in that it did indeed have jurisdiction.

In San Antonio, meanwhile, the other appeals court struck down an injunction issued by the Hidalgo trial court preventing Dugger & Holmes from fracturing its well. It ruled the state law "says expressly that this is a matter to be administered by the Railroad Commission."

What it means . . . the Delhi-Mayfair attack on small-tract drilling via the trespass laws opens several interesting possibilities.

First, the rulings favorable to these operators do not prohibit fracture treatments as such—only those which would send fractures across lease lines. There is no known way at present to say exactly how long fractures will be created by a certain size fracture iob in a given zone. This will make it difficult in many cases to define whether trespass will occur.

Further, if trespass should prove a valid grounds for court action against fracturing, it poses other questions of concern to operators.

For instance, an operator might be sued for damages due to trespass that had been committed in the past. The law of trespass has been on the books for years and the fact that a fracture treatment was performed before it was known to constitute trespass probably would not be an effective defense, some attorneys feel.

Also, an operator might be open to suit for damages by his own royalty owner. This could occur where an operator held several adjacent leases not in a unit. He might fracture a well on one so that fractures crossed the line of another of his leases. It is suggested that the operator could be sued by the owner of the royalty under the latter lease.

How long in doubt? . . . It is far from clear at present when the courts will finally resolve the issues.

A spokesman for Delhi-Taylor told the Journal in Dallas last week that the decision in San Antonio will be appealed to the state supreme court.

The second suit apparently will go back to the Hays County court for trial on the merits.

Lid Stays on Texas Allowable

Texas oil wells will produce in July on a lean 8-day schedule for the third consecutive month.

The Texas Railroad Commission, confronted with a narrow choice between 8 and 9-day schedules, each favored by half a dozen major buyers, picked the lower pattern.

Major factors in its decision, apparently, were higher-than-desired stocks of Texas crude plus heavy pressure from independent operators for the 8-day rate at the June 20 hearing.

The initial allowable for July was fixed at 2,596,609 bbl. per calendar day. This is a cut of 46,907 bbl. daily from the initial allowable for June and a decrease of 26,436 bbl. daily from that in effect June 4. The decrease is due to the extra calendar day in July.

Nominations conservative . . . Purchasers recommending the 8-day pattern included Sinclair, Conoco, Cities Service, Atlantic, Gulf, and Phillips. Of these, Phillips and Gulf originally nominated 9 days but switched to 8 at the hearing.

TEXAS ALLOWABLE BY DISTRICTS

District—	July	Change from June 4
1. Southwest	48,421	+ 375
2. Gulf Coast	101,479	— 2,055
3. Gulf Coast	340,838	— 3,753
4. Southwest	172,787	— 2,355
5. East Central	27,936	— 317
6. Outside East Texas Field	109,134	— 1,747
6. East Texas Field	122,156	— 1,670
7-B North Central	151,941	— 185
7-C West Central	120,327	— 342
8. West Texas	1,025,414	— 19,467
9. North Texas	241,939	+ 3,762
10. Panhandlie	134,237	+ 1,318
Total	2,596,609	— 26,436

Most of the bigger buyers, however, sought the 9-day schedule. These included Humble, Mobil, Shell, Texaco, and Standard of Texas.

Texas Severance Tax Flayed, Ruling Due

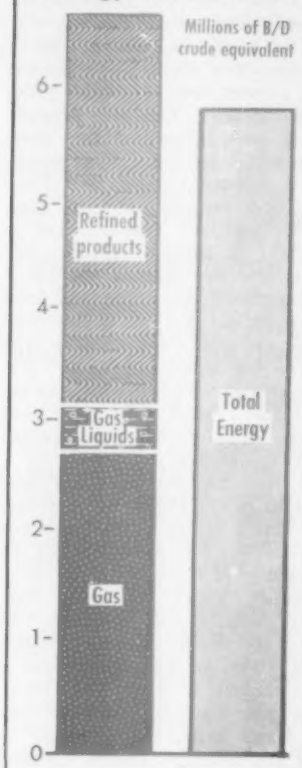
FINAL SHOTS have been fired in the first round of the court battle by gas pipelines to overturn Texas' severance-beneficiary gas tax.

Arguments by both sides have been completed before the 126th District Court in Austin. The issue is awaiting decision. District Judge Jack Roberts expects to rule within the week on two cases involving seven of the long lines.

The severance tax, passed by the Texas legislature last summer is bringing in about $7,500,000 a year in revenue. Nearly all of about $6,370,000 collected to date was paid under protest and is held in escrow by the state comptroller.

No matter who wins in the District Court, the decision is certain to be appealed. The battle eventually is ex-

Oil Faces Some New Growth Problems



TAKE A LOOK at what is happening to the nation's total energy picture.

Oil and natural-gas production is continuing to grow faster than over-all energy requirements.

It has been able to do this by cutting into the energy market of other fuels, chiefly coal.

But there is a limit to that type of expansion.

The net effect, therefore, is that in the years ahead, oil and gas production gains will have to conform more nearly to the growth of the nation's energy requirements.

For oil products, the slowdown may be even more pronounced if natural gas continues to make the rapid gains of recent years, cutting deeper and deeper into oil's markets.

As a result, oil faces the prospect of having a lower annual growth rate than total energy requirements—instead of the more rapid rate it has enjoyed in the past.

Long-range, oil could face the same sort of squeeze from natural gas that coal has suffered from oil and gas.

A glance at the accompanying charts will show that may be happening even faster than you had realized.

Note particularly the 1956-59 comparison of natural gas expansion with that of the growth of total energy demands.

One factor which may eventually slow these rapid gains by gas is the upward pressure on natural gas prices.

pected to carry all the way to the U. S. Supreme Court.

Attorneys for the companies contend that the tax is an old wolf dressed in new sheep's clothes—that it is another version of the gas-gathering tax struck down by the Supreme Court several years ago.

They contend that the new beneficiary tax is unconstitutional because it "violates not only the interstate commerce laws but the due process clause and the equal protection clauses of the U. S. constitution."

An attorney for Tennessee Gas Transmission Co. termed the tax "a legal fiction" and accused the legislature of trying to work some "plastic surgery."

Attorneys for the state, on the other hand, argued that the tax was carefully drawn to apply equally to interstate and intrastate firms.

Defense of the tax was led by Will Wilson, Texas attorney general. Wilson said he could see no difference in Texas taxing gas leaving its borders and Michigan, for instance, taxing automobiles which eventually are sold to out-of-state consumers.

Congress Aims at "Ex Parte"

- **Proposed legislation would make it tough for an industry representative to talk to a regulatory agency about a case.**

CONGRESS took the first step last week toward closing the door to private contacts between officials of industries and of six agencies which regulate them.

The House Commerce Committee voted unanimously June 22 to report to the full House of Representatives a measure providing fines up to $10,000 and up to a year in jail for certain private approaches.

The measure applies specifically to the Federal Power Commission, Federal Trade Commission, Interstate Commerce Commission, Securities and Exchange Commission, Civil Aeronautics Board and the Federal Communications Commission.

The measure, introduced by Rep. Oren Harris (D-Ark.), chairman of the committee, defines an ex parte contact one where "reasonable notice is not given in advance to all interested parties." The ex parte contacts are barred from the time a hearing date is set. A request as to the status of a case is permitted.

Chairman Harris said he planned to push for congressional action in this session, but observers felt that time is running short.

The measure declares it is "improper" for a person to attempt to influence actions of any agencies "by the use of secret and devious methods calculated to achieve results by the exertion of pressures, by the spreading of false information, by the offering of pecuniary or other inducements, or by other unfair or unethical means, rather than reliance upon a fair and open presentation of facts and arguments in accordance with established procedures."

CROSSING a stream is often done by aerial span, but on this one . . .

Gas Line Goes Under a River

• For the first time, a submarine route is being used to cross the Colorado River. It costs more but has benefits, too: Improved safety and possibly lower maintenance costs.

THE FIRST underwater crossing of the Colorado River by a big-inch gas-transmission line will be wrapped up this week and may set a pattern for future crossings of the stream.

Pacific Lighting Gas Supply Co. and Transwestern Pipeline Co. are laying twin 24-in. lines under the river in a definite departure from past pipelining construction using aerial spans to cross the river into California. The submarine crossing is being made about 7 miles north of Needles, Calif., on the Arizona-California border. The installation is being inspected by Pacific Lighting Gas Supply.

The twin lines tie into Transwestern's 30-in. system which will start moving West Texas and North Texas gas into the California market late this summer. Pacific Lighting Gas Supply is building a 116-mile line from Needles to Newberry, Calif., to handle the Transwestern gas. All of the PLGS line is 34 in., other than the river crossing.

The twin submarine lines cost Pacific Lighting Gas Supply 20% more than a single 30-in. overhead line, but the company figures it made a good deal going under the river rather than over it, which has been the past practice.

Maurice E. Fuller, the company's chief engineer, says the submarine lines have three advantages:

. . . **Maintenance costs** will be negligible. Fuller says the paint bill on an overhead line would be more than it will cost to cathodically protect the submarine lines.

. . . **More capacity** is available in the two 24-in. lines than in a single 30-in. line. The twin lines are designed to handle 640,000 M.c.f. daily.

. . . **Safety** is a prime factor. There are virtually no safety hazards with the line buried under the river.

What is involved . . . Pacific Light Gas Supply originally was slated to cross the Colorado at Topock, where four big-inch gas lines now span the river.

"All the good crossing sites at Topock are taken," Fuller said. "We couldn't find a feasible place for us to cross without becoming a hazard to ourselves and to existing lines."

So the companies looked for another crossing site and settled on the present location, which is 20 miles upstream from Topock.

Fuller says a submarine crossing at Topock is virtually impossible. There are lava beds on the west bank of the river and rocks in the river bed which make ditching difficult. An overhead span at Topock would have run about 1,000 ft., but at the present site it would jump to about 1,500 ft. This long distance overhead also influenced the company to make the first stab at laying a line under the river.

The river is only 458 ft. wide north of Needles, but the line is laid 1,400 ft. on a level in order to carry the line outside the flood plain on the Arizona side and into the bank on the west side of the river.

A heavy pipe (⅝-in. thick) was used for the submarine lines. The pipe is double wrapped with coal-tar enamel and coated with reinforced concrete. The coated pipe weighs 360 lb. per foot.

The line for the crossings was welded in two 1,400-ft. sections and pulled across in about 1½ hours for each section. The lines are 14 ft. under the river bed.

Missouri Valley Dredging Co., Omaha, installed the crossings. In making the ditch, Missouri Valley used a 10-in. suction dredge and a 12-in. suction dredge. The 12-in. dredge was equipped with an agi-peller which loosened the rocks.

The remainder of Pacific Lighting Gas Supply's line to Newberry is being laid by a joint venture of Engineers Limited Pipeline Co., San Francisco, and Pacific Pipeline Construction Co., Montebello, Calif.

PIPELINE

About 49 miles of 2 to 6-in. crude line is planned by Service Pipe Line Co. this summer and fall. The mileage includes various gathering lines to connect new leases to the system.

Some 385 miles of gas line will be laid in 1960 and 1961 by Coastal States Gas Producing Co. and subsidiaries, Corpus Christi, Tex. Contracts have been awarded to Adair Pipeline Co. for 30 miles of 8-in. and 30 miles of 6-in. from LaSalle County to Pearsall, Tex., and 25 miles of 8-in. from Jim Wells County to Agua Dulce, Tex. FPC applications have been filed for a 30-mile 12-in. line from Jim Wells County to the May field, Tex., area and 230 miles of 4 to 20-in. from Live Oak County to Lavaca County. A 40-mile 4 to 14-in.

The contractors, who are using the bell-hole method in laying the line, have welded all of the line and expect to have it completed by July 15.

At Newberry, the Pacific Lighting Gas Supply line ties into a 36-in. system being laid by two affiliates, Southern Counties Gas Co. and Southern California Gas Co.

Drilling firms join forces to cut overhead, increase efficiency

BIG CHIEF Drilling Co. of Oklahoma City has taken over administration and supervision of field operations of Schafer Drilling Co., Oklahoma City, operator of five rigs in the 3,000 to 9,000-ft. range.

The unusual agreement, under which both companies retain separate identities, was reached "to save money and get greater use out of equipment," according to Jack Abernathy, Big Chief president.

Big Chief has 14 deep drilling rigs and has been in business since 1936. Harry J. Schafer is president and Harry J. Schafer Jr., executive vice president of the 9-year-old Schafer company. William T. Payne is board chairman of Big Chief.

The companies expect to keep field personnel of both organizations. With Big Chief handling all bidding, obtaining of contracts, and supervising operations, much overhead will be saved, Abernathy said.

Unions Fight Work Farmouts

• Union efforts to block contracting of work by oil companies now make up 40% of all arbitration cases.

ONE OF THE chief conflicts between labor and management these days is over the move by many firms to have more of their maintenance and construction work done by contractors rather than by their own employes.

Management's motive is efficiency and reduced costs. Labor is unhappy when jobs disappear.

Evidence that the contracting of work is a growing issue is shown in a breakdown of the causes of conflicts which reach the stage of arbitration.

Of all arbitration cases, about 40% involve contracting of work. Other reasons: managerial rights, 8%-9%; employe discharge cases, 22%; job classification, 12%, and seniority cases, 20%.

These figures were given at a recent industrial relations session of the Western Petroleum Refiners Association in Wichita, Kans., by the Rev. Leo C. Brown, professor of economics at St. Louis University. Brown is president of the National Academy of Arbitrators.

Brown said, in commenting on management's desire for more freedom in job classifications and work assignments, that an arbitrator would be likely to permit such action provided the contract does not specifically prohibit it.

He did point out, however, that in some instances where a work force is reduced by some technological improvement, the remaining jobs may require more skill. This may give the union an opening to bargain for higher rates of pay.

Other trends . . . Another panel member, Robert H. Moore, deputy director of the Federal Mediation and Conciliation Service, also commented on the problem of contracting out work, pointing out that companies are seeking more freedom to do this and to make job assignments.

Outlining some of the trends in labor negotiations, Moore said that:

. . . **Amount of insurance** is increasing and there is a definite trend toward noncontributory insurance plans.

. . . **Pension plans** are becoming more liberal.

. . . **Average contract** now allows about 7½ holidays per year.

. . . **Shorter work week** is not getting too much rank-and-file support now.

Taking industry as a whole, there now exists the most balanced attitude toward collective bargaining that he's seen in a long time, Moore said. Industry's attitude is firm and insistent. For the most part, the Landrum-Griffin bill took labor by surprise and they're not sure just how to proceed.

BRIEFS . . .

line is planned from Jim Hogg County to Zapata County.

Contracts have been awarded by Hope Natural Gas Co. to M. & R. Pipeliners, Inc., for 19 miles of 20-in. in West Virginia. A 9-mile line will be completed next month from Kennedy station to Dry Fork, and a 10-mile line will be completed in September from Ellenboro to Schultz.

A 63.5-mile 8-in. crude line from Maverick to Pearsall, Tex., will be completed by Humble Pipe Line Co. by July 15. Contract has been awarded to H. S. Ahanks & Sons, Alice, Tex.

Some 200 miles of pipeline construction has been let by Texas Eastern Transmission Corp. to H. C. Price Co., Western Pipe Line, Inc., and Sharman, Allen, Gay & Taylor. The projects include 85 miles of 24-in., 40 miles of 36-in., 23 miles of 20-in., and 53 miles of 30-in. in Pennsylvania and New Jersey.

Construction has started on Michigan Wisconsin Pipe Line Co.'s expansion in connection with increased supply to be received from Midwestern Gas Transmission Co.'s line from Canada. Michigan Wisconsin has awarded contracts for 92 miles of 24-in. from Appleton to Marshfield, Wis., to Houston Contracting Co., Houston; 85 miles of 16-in. from Weyauwega to Marinette, Wis., to Hallmac Construction Co., Houston; 111 miles of 4 to 8-in. to Panama-Williams Corp., Houston; and 31 miles of 4 and 6-in. to R. H. Fulton & Co., Lubbock, Tex. Completion is scheduled October 1, 1960.

Also for Pipeliners . . .

IN THE NEWS: Decision pending in pipelines' court fight to overturn Texas' severance-beneficiary gas tax (p. 76) . . . House takes first step to close door to private industry-regulatory agency contacts (p. 77) . . . Big-inch gas line makes first underwater crossing of Colorado River (p. 78) . . . FPC examiner cuts Tennessee Gas Transmission offshore gas price (p. 86) . . . Alaska's first gas line may make it to Anchorage by October (p. 91).

PLUS THESE TECHNICAL REPORTS: Special 16-page Journal report on what it costs to build and operate gas pipelines (p. 99) . . . Pipeline construction report (p. 137).

Nation's biggest market lures another major marketer as . . .

Humble gets a foot in California's door

Start is modest with purchase of a small independent, but few doubt the company will eventually field a mighty team

Carl Lawrence
West Coast Editor

"COMPETING with Jersey Standard is like playing Notre Dame."

That's how George Getty, president of Tidewater Oil Co., views the arrival of Humble Oil & Refining Co., Jersey's domestic operating company, on the West Coast marketing scene.

Right now, Humble looks more like Slippery Rock than Notre Dame as far as West Coast marketing is concerned. The company moved into the area as a marketer late in May with the purchase of Major Gas Stations, Inc., an unbranded marketer with 11 outlets in Los Angeles. But there is little doubt that Humble will some day field a mighty team on the West Coast.

Top officials of both Humble and Jersey Standard have left no doubt that one of Jersey's goals is to become an established marketer across the nation.

Jersey moved into Indiana Standard's marketing territory for the first time about 3 years ago by purchasing Pate Oil Co. of Milwaukee and Oklahoma Oil Co. of Chicago. More recently, Jersey edged into Standard of California's territory by buying outlets in Arizona. The company also made a recent move into the Ohio market. The purchase of the Major Stations put the company in California and Nevada for the first time.

With Humble's Carter division marketing in the Rocky Mountains and Pacific Northwest and the Esso division on the East Coast and southeastern states, there are only a few isolated areas where you won't find either the Humble, Esso, Enco, or Carter oval on gasoline pumps.

Jersey officials have indicated they hope to market in all parts of the country under a single trade name. What this trade name will be and when it will come into existance are favorite topics among marketing men.

What next? . . . You get a variety of opinions on when Humble will become a big factor in the California market.

One marketing executive hazards a guess that it will be only a year. But most other marketing men think it will take 3 or 4 years—or maybe more—before Humble grabs any sizable portion of the California market.

Getting a supply of products is the key to Humble's expansion in the West. Buying Major didn't bring Humble any gasoline supply. Major is strictly a marketing firm.

Exchange agreements or outright purchases are Humble's only means of getting products for the California market and it is doubtful it can become a big factor until it acquires or builds a West Coast refinery. Most competitors think Humble will buy rather than build. Their thinking is governed in part by the fact that there is plenty of refining in California.

Time Oil Co., a Los Angeles wholesale distributor with some retail outlets, is the company most frequently mentioned as Humble's next acquisition. Time would give Humble terminal and storage facilities, which are hard to come by in southern California. Time also controls U. S. Oil & Refining Co., which has a 14,000-bbl. refinery at Tacoma, Wash.

But the Justice Department may put a damper on Humble's plans to swallow up Time or any other company. The department has indicated it would frown on a Humble-Time merger, and this antimerger feeling in Washington very well could change Humble's timetable for moving again into California.

However, nothing was said in Washington about the Major purchase, so

Humble may go the route of buying out strictly retail marketers until the Washington atmosphere changes.

Early this month the report was out that Humble is negotiating for a merger with Monterey Oil Co., which has no retail outlets but is an established California crude producer. Monterey has about 10,000 bbl. daily production in California.

In most places, Humble needs crude oil like it needs a hole in the head, but acquiring crude production in California would be a smart move. Humble could swap the crude for products or it could use it if and when it acquires a refinery.

There are some other candidates Humble might buy.

Getty says Tidewater has been approached by "two or three small refiners" in recent months who would sell if offered the right price. Their biggest selling point, Getty says, is their import quotas.

These companies aren't attractive to established California refiners since the throughput of the small plants would merely be added to present throughput and the established refiner wouldn't get much of an increase in its import quotas.

But to a company like Humble which has no West Coast refining capacity, they might be attractive. Should Humble acquire one of the small plants, it would get full benefit of any import quota. And on the West Coast, import quota percentages are much more liberal than on the East Coast, hitting a high of 45% of throughput for a plant running 10,000 bbl. or less.

Getty also points out that the retail outlets offered by these small companies are generally in areas where established West Coast firms already have outlets.

The market . . . California has plenty to offer any gasoline marketer.

U. S. Census Bureau figures are a good indicator of the tremendous growth in southern California during the past 10 years. Los Angeles county had a whopping 44.2% increase in population, reaching 5,987,240. And the city enjoyed a healthy 24.4% increase to 2,451,862.

Fortunately for gasoline salesmen, there is nothing to indicate Los Angeles County's population growth will be stunted anytime soon. One optimistic marketing executive in southern California says he figures "a town of 7,000 people" has moved into his territory each week.

Los Angeles has grown as if its architect were a gasoline marketer. Rather than growing upward as most cities do, Los Angeles has spread out. Earthquake restrictions limited the height of buildings for many years. These have been lifted, but only after the city spread over much of the country. And all this means more driving.

Based on the new census figures, there is one passenger car in Los Angeles County for every 2.2 people. And the long distances mean these motorists drive more than normal.

And as the number of people and cars increase, so do gasoline sales.

Last year, taxable gasoline sales in the state increased nearly 7% over the previous year reaching a total of 5.5 billion gallons. Passenger-car registration hit 6,267,864. This figures out to an average consumption of 870 gal. annually per automobile.

Who will suffer? . . . Gasoline sales are expected to increase about 5% annually over the next few years in California, but someone may have to move over to make room for Humble's entrance into the market.

The California retail market is split about 80-20 between seven majors and the independent refiners and marketers.

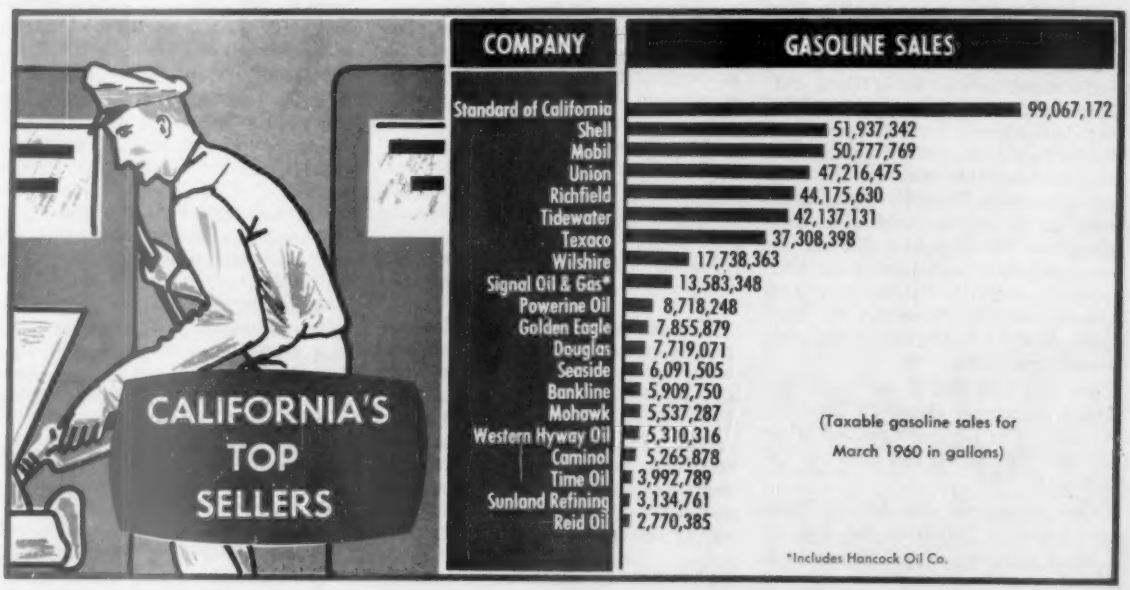
Standard of California is the recognized market leader with slightly over 20% of the market. The company markets under three types of stations: Standard, which are the company-owned stations; Chevron, which are lease stations; and Signal Oil Co., which is the old marketing arm of Signal Oil & Gas Co. Signal Oil & Gas markets under the Hancock name in southern California.

Marketing under more than one brand name is nothing new in California. All the majors do it except Texaco and Shell. However, these secondary outlets for the majors aren't much of a factor in the over-all market.

Second behind Standard of California in retail marketing is Shell with about 12% of the market. Three majors, Union, Richfield, and Mobil, each have about 10% of the market. Tidewater has about 8.5% and Texaco just over 8%.

The melon may be split a different way once Humble becomes established, but the majors are all going to do all they can to see that they retain their share of the market, plus any more they can grab.

Other newcomers . . . Humble isn't the only company with its eyes on California.



In fact, one marketing man said he wouldn't be surprised if one of the other majors not marketing in California beats Humble in becoming a big factor in the market.

Four other companies obviously missing from the list of seven majors marketing in California are Gulf, Continental, Phillips, and Indiana Standard. Cities Service and Sinclair are both represented on the West Coast through part ownership in Richfield.

It has long been rumored Gulf would move its brand into the California market through Wilshire Oil Co., California's biggest independent refiner-marketer. Wilshire ranks right behind the seven majors in gasoline sales. There was a report last week that Gulf will announce about July 1 it is taking over direct operations of Wilshire, which it now controls through another affiliate.

Gulf and Phillips have both been linked with Union Oil. Just last month it was revealed that Phillips has acquired approximately 13% of Union's common stock as an "investment."

Gulf holds convertible debentures for 25% of Union's stock, but it would be cheaper for Gulf to buy stock at the going rate of about $38 than to exercise its option on the debentures. Gulf made the debenture deal with Union in 1956 (OGJ, Apr. 9, 1956, p. 67).

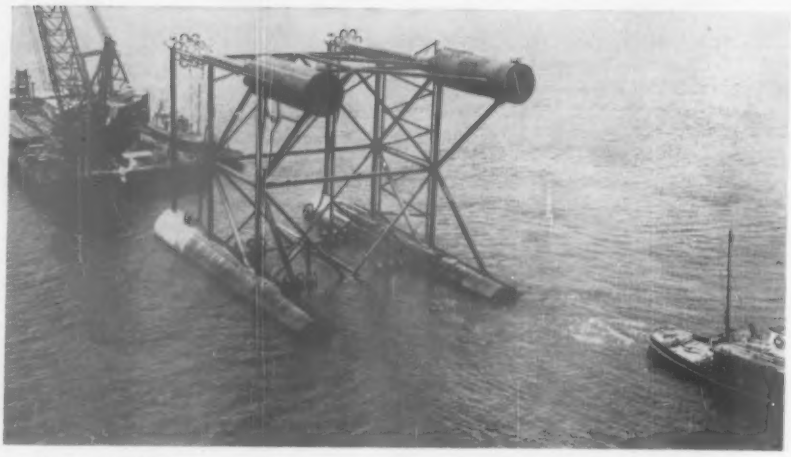
Douglas Oil Co., one of the healthier independent refiners and marketers, may be the next company sold in California. Continental reportedly has first option on Douglas with American Oil Co. (Indiana Standard) second option. Douglas has three small refineries with a combined capacity of 18,500 bbl. daily and the company ranks about twelfth in the retail marketing race.

California's established companies aren't standing still while these outsiders look over the state's potential. One independent crude producer, Pauley Petroleum, Inc., is giving some serious thought to entering the marketing business. Pauley's organization went so far as to prepare a press release on his company entering the marketing field with multigrade marketing. In fact, the release was inadvertently mailed. However, the company quickly killed it, explaining plans weren't completed.

But the talk that keeps marketing circles buzzing is Humble's future in the state. The big questions are when will they buy again and how big will they get?

One competitor summed up Humble's future in California this way:

"Hell, they've got enough money to do anything they want!"



BASE of what will be a 24-well permanent platform is towed to location.

Setting Up an Offshore Platform

THE OFFSHORE platform "Hilda" acted like a good girl last week when she was set up about a mile off the coast of California.

It took only about 26 hours for Standard Oil Co. of California to tow the platform from San Pedro and to set it up off Santa Barbara County. "Hilda" and a sister platform, "Hazel," will work for Standard of California on the Summerland lease, held jointly with Humble Oil & Refining Co. There is still some work to be done before "Hilda" will be ready to go to work. Drilling operations aren't due to begin until August, but the installation of the

States Wrestling with

...in an effort to avoid severe crude market disruptions.

Officials studying raft of possible corrective measures.

THE "deteriorating position" of Mid-Continent crude oil has the commissions of several southwestern states scrounging for ways to reduce overproduction and preserve historic markets.

The Texas Railroad Commission continued its record-low 8-day allowables schedule through July and began wrestling with a prodigous hearing record on the desirability and feasibility of curtailing waterfloods and other wells exempt from proration (p. 73).

The Kansas Corporation Commission is bracing for a series of legal battles stemming from its order shutting in all fields in two counties when Derby Refining Co. posted a price cut.

The Oklahoma Corporation Commission is pondering a raft of suggestions for paring the state's crude output down to a level that purchasers say is the market requirement.

The Oklahoma problem . . . Nominations to buy Oklahoma crude totaled only 488,750 bbl. per day, compared with current production of 509,000.

Two large Oklahoma buyers, Rock Island Oil & Refining Co. and Kerr-McGee Oil Industries, Inc., are prorating purchases to 80% of their May takings, Kermac has asked permission to cut to 60% during July, and a third—Champlin Oil & Refining Co.—has announced it will have to prorate purchasers unless it can sell some of its surplus.

The OCC's conservation director, Massena Murray, described the situation as drastic, with no relief in sight for 3 months. Among the suggestions for curtailment he submitted to the commission were:

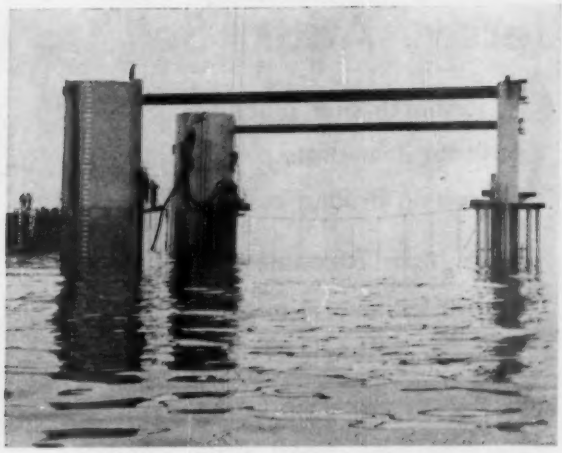
. . . **Shutting down** all wells in Oklahoma for 15 days.

. . . **Cancelling** discovery allowables for 3 months.

. . . **Prorating** waterfloods.

. . . **Tightening** supervision over

WATER floods legs, causing platform to tilt . . .



. . . AND the platform settles to the ocean floor.

Is Easy if You Know What You're Doing

base of the platform went off without a hitch. The base is 148 ft. high and is sitting in 106 ft. of water. The four legs are arranged in an 80-by-75 ft. pattern. A main deck 120 ft. square will be added soon. The second deck will house the drilling equipment for the 24-well platform.

"Hazel" will be outfitted like her sister. Both will be capable of drilling two wells simultaneously (OGJ, Sept. 21, p. 112). The two platforms will be linked together with a pipeline running to onshore storage facilities at Carpinteria. Standard of California and Humble have been drilling on the Summerland lease since 1958. Daily production of about 1,000 bbl. has been developed on the 5,500-acre offshore tract.

The arrival of "Hilda" proves that the two companies figure there is still a lot of oil to be found in the tidelands lease.

Mid-Continent Surplus

waterfloods and other types of production exempt from proration.

Few bright spots . . . At both the Texas and Oklahoma allowables hearings last week it was noted that the nation's stocks of crude and refined oils are still much above the levels considered desirable.

Purchasers pointed out that refineries have reduced their runs and are trying to work down their stocks, and that this condition may continue all summer.

Oklahoma was described by some purchasers as a "high-price island," with crude from surrounding states reaching refineries in the Great Lakes area as much as 10 cents per barrel cheaper. Also mentioned as darkening Oklahoma's market picture were sales of Rocky Mountain crude below posted prices, a reduction in pipeline rates from the Rockies to Great Lakes refining points, and the recent cut of 15 cents per barrel in Illinois Basin crude.

This situation has the Oklahoma Corporation Commission studying a proposal that it petition the Interstate Commerce Commission to investigate pipeline tariffs on crude oil out of the state with a view to reduction.

Independent producers are reacting variously to the deteriorating crude market. At the Texas hearing two groups asked for low allowables in order to reduce aboveground stocks and prevent purchaser proration.

At the Oklahoma hearing one producer group asked the commission to set a high allowable and force the purchasers to take all crude offered.

This is a touchy subject for the Oklahoma Corporation Commission. It must go before the state's supreme court shortly to defend its 1958 action fining Gulf Oil Corp. for prorating without commission approval.

Kansas outlook . . . In Kansas, independent producers are trying a still different set of tactics.

When Derby cut its postings 20 cents a barrel in two counties where it was the sole buyer, they induced the Corporation Commission to shut down the entire area under Kansas' "economic waste" statute. Derby is taking the commission to court on this.

Meanwhile the Kansas independents are attempting to market their crude themselves and claim to have found some buyers at the former price provided the oil can be moved to other trunk pipelines through Derby's gathering system.

They seek a KCC order declaring the system a common carrier. Derby is resisting, terming it a private plant facility. A court battle on this issue, too, is framing up.

Lost markets? . . . The price deterioration in the Illinois Basin is worrying producers everywhere.

During the past 2 weeks most—but not all—purchasers in the area have reduced their postings by 15 cents per barrel, and the cut now affects a large volume of crude produced in various portions of Illinois, Kentucky, Indiana, Ohio, and Michigan.

The spread to Michigan forced principal buyers in that state to meet the cut, prompting a general apprehension that the entire eastern producing region would soon be on the lower posting.

This prospect posed the question: Can crudes from the Southwest, Mid-Continent, and the Rockies find a market in Great Lakes area refineries without meeting the 15-cent price reduction of the local crudes? And will this trigger a reduction in crude prices almost everywhere?

Jersey Adds "Sell" to Its Drilling Research

- **Research arm plans to push for immediate profits by cutting drilling costs.**
- **Its plan: Take latest known techniques into the field for problem solving.**

FINAL CHECK of plans for the drilling research "sales" trip of Alan P. Roberts, left, is made by T. O. Allen before Roberts leaves on the world tour.

RESEARCH results aren't worth much unless they are used.

That's the theory behind a new "sales" program of Jersey Production Research Co. The program's goal: Get the latest proven drilling and development techniques into the field.

As a starter, Jersey Production has sent a young research engineer, Alan P. Roberts, on a world tour with three thick, mimeographed volumes which include the latest drilling and production knowhow.

He will make stops in the Far and Middle East to pass on the information to field people.

Jersey Production people estimate that maximum use of known drilling methods can cut millions of dollars off the annual drilling bill of the parent Standard Oil Co. (N. J.).

This ties in with Jersey's present corporate objective. In recent years Jersey has built for the future. Now, it figures its long-term position is strong and immediate profits should be emphasized.

Last year the annual worldwide producing budget, which includes drilling, was about $460,000,000. A sizeable cut in this figure would fit Jersey's program perfectly.

T. O. Allen, manager of Jersey Production's drilling and development division, cites the opportunities for cutting rig time.

The cost of running a rig abroad ranges from $3,000 to $8,000 a day.

"It is not unusual," Allen says, "by tailoring improved practices and equipment to the job, to decrease drilling time by 25 to 30%. In many cases the reduction has been even greater."

Cash and carry trip . . . The touring Roberts, who heads the well-completion and development section of Jersey Production has a rough route. Every stop represents at least one problem referred to his company for assistance.

Now in Sumatra, he is teaching three classes. His students are Standard Vacuum petroleum engineers, pushers, and formen. Jersey has a 50% interest in this firm.

Other stops scheduled are Iran, Saudi Arabia and Libya. It is expected that Roberts will make cash for the affiliates there by using "instant" research to tailor known methods to some of their difficulties.

In turn, Roberts will probably have to carry some problems back to Tulsa for thorough research.

Other round-the-world sales trips are expected to follow this one. Allen believes they will serve a useful purpose. Some advantages:

. . . **Field contacts** stimulate the airing and solution of more problems.

. . . **Confusion** about newly advanced methods and tools can be cleared up. Personnel in the field sometimes have difficulty in determining the worth of claimed breakthroughs, since these men occasionally are so far removed from professional societies, laboratories, and other testing grounds.

As Allen says: "Probably less than 25% of proposed new drilling techniques and tools will float. The floaters are what we want to use, not the sinkers."

Deep, Three-Level Flood Nearly Ready

WORK probably will start in July on the deep, triple-zone flood of Eola field in Garvin County, Oklahoma.

The program is believed the world's deepest water flood and the first three-zone project. Pan American Petroleum Corp. is the operator (OGJ, April 18, p. 95).

Drilling on the input well will start in late July or August. The well will inject water through three separate strings of tubing into the Bromide, McLish, and Oil Creek zones between 9,800 and 11,000 ft. on the northwest fault block of the field.

Approved unit for the McLish covers 560 acres, the Bromide 520 acres, and the Oil Creek 440 acres.

Source of the water will be Pontotoc sands lying between 1,800 and 3,000 ft. The injected water is expected to move the water level uniformly upstructure to displace the oil. At a later date gas may be injected to displace attic oil in the Oil Creek zone.

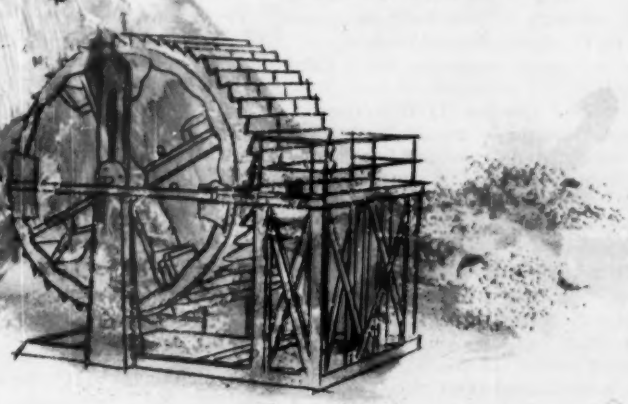
The single input well will take care of all three zones, although the Oklahoma Corporation Commission approved separate unit agreements for the three formations. A minor interest holder has filed suit contesting the Oil Creek unit. Operators, however, voted to proceed with the work anyway.

Other working interests are held by Amerada Petroleum Corp., Anderson-Prichard Oil Corp., I. R. McQueen, Republic Natural Gas Co., Sohio Petroleum Co., and Superior Oil Co.

THE QUALITY OF THINKING

From an almost unlimited scope of thought, Leonardo da Vinci brought forth a stream of inventions which — in modern form — are in use today. However, Leonardo's greatest contribution was simply the triumph of creative thought applied to practical results. His work will stand for all time as proof that the appraisal of quality applies to thinking as well as to tangible objects and to visible or audible processes.

In a related sense, the quality of engineering is measured by results. And it is by results alone that the minds responsible for an engineering project can be evaluated. When you check the record of Brown & Root's engineering through the years, the high quality of thinking is self-evident. Customer satisfaction from greater efficiency at lower costs has built a worldwide reputation for engineering and construction by Brown & Root.



This squirrel-cage blower, invented by Leonardo da Vinci and put to practical use, was a significant step toward modern mechanical air conditioning.

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Percentage-Depletion Foes Lose Again

PERCENTAGE depletion has again survived the annual attack made against it in Congress.

When the floor show was over, the Senate voted down a sliding-scale percentage cut by a vote of 56 to 30.

However, depletion foes figured they actually had 36 senators on their side. This included four who were paired for the cut and two who would have voted for it had they been present.

The previous high for the opposition was 35 in 1958.

A new approach . . . One new development in this year's fight was a proposal by Sen. Albert Gore (D.-Tenn.) that the limit on the amount of depletion that can be taken be reduced to 33⅓% of taxable income instead of the present 50% limitation.

Gore said this would be a more realistic and practical way of reducing percentage depletion than the sliding-scale formula that was being considered.

He said it would hit only those with high net profits, and that it would yield the treasury an additional $250 million a year in taxes.

However, Gore decided to withdraw his proposed amendment before it reached a vote.

Same old story . . . For the most part, this year's attack was made the same as in past years—somewhat like a TV rerun.

Sen. Paul Douglas (D.-Ill.) offered a depletion-cutting amendment to a bill which would continue corporate tax rates at 52%.

He called oil's 27.5% percentage depletion "the greatest tax racket in the entire American revenue system."

He warned that unless it is scaled down "a storm of indignation" will prompt more rigid requirements.

He had vocal backing from Sen. Frank Lausche (D.-Ohio), Gore, and Sen. John Carroll (D.-Colo). Lausche warned of a "rebellion" unless something is done.

Supporters of the tax provision included Sen. A. S. Mike Monroney (D.-Okla.) and Sen. Frank Carlson (R.-Kans.).

The sliding scale proposed by Douglas would work like this: Producers with less than $1 million a year in gross revenues would still get 27.5%, incomes between $1 million and $5 million would get 21%, and those over $5 million would be eligible for only 15%.

Although the proposal was beaten, it is quite likely that it will be made again before the current session ends.

Court rules different prices discriminatory

THE U. S. SUPREME Court has ruled that a price difference is a price discrimination, but it hasn't set a yardstick for determining when such a discrimination is illegal.

The court's action was in a beer case, but it has overtones for oil marketing because some parallel situations exist.

At stake is whether a company can sell a product for one price in one area and another price in another area.

The Federal Trade Commission had originally ruled that this constituted price discrimination. But an appeals court held that other factors must be considered.

The Supreme Court upheld the view of the FTC and overruled the lower court. The case—involving Anheuser-Busch, Inc.—was sent back to the appeals unit for a determination of whether the price discrimination was legal or not.

These developments were watched with particular interest by Pure Oil Co., which has been charged by the FTC with illegal price discrimination because it cut its gasoline prices in Birmingham, Ala., without reducing them in its other marketing areas.

Apparently the outcome of such price discrimination cases rest on the impact a price cut has on competition in a given area.

The decision for Pure is still far away. After 2 weeks of hearings recently before the FTC, the case was continued until September, 1961.

FPC examiner chops offshore gas price

A FEDERAL POWER Commission examiner last week approved sales of offshore Louisiana natural gas to Tennessee Gas Transmission Co.—but at 16.4 cents per thousand cubic feet instead of the proposed price of 21.3 cents.

The gas involved had originally been sold to Niagara Gas Transmission Ltd., with Tennessee transporting it to the U. S.-Canadian border near Niagara Falls. The sale was made under a 1953 contract at a price of 16.4 cents, with the contract calling for price redetermination every 5 years.

In 1958, the price was set at 21.3 cents, but Niagara then ceased purchasing the gas and assigned its rights to Tennessee.

Because of the change in purchasers, the FPC examiner ruled that the 21.3 cents Tennessee agreed to pay was an initial rate, rather than an increase in the 16.4-cent price.

He ruled further that the 21.3-cent price was based "simply on the operation of an escalation clause, rather than on the basis of any evidence showing that the initial or escalated price was one which should be authorized in a certificate proceeding."

He said the 16.4-cent price would protect the consuming public "until a just and reasonable rate for the service is determined by the commission."

Phillips Petroleum Co. and Kerr-McGee Oil Industries, Inc., are the producers of the gas, most of which comes from the Rollover Field. The contract calls for delivery of 60,-700,000 cu. ft. daily.

Despite past rebuffs, firms file import pleas

OIL COMPANIES again are asking the Oil Import Appeals Board for new or larger quotas to import crude oil or oil products, despite their lack of earlier success.

The current round of appeals is from quotas for the last half of this year.

For companies which received quotas, the deadline for appeals was approximately June 24, depending on the date on which companies received notice of their quotas.

For companies which did not receive quotas, the deadline to ask for them is July 15.

As the first deadline neared, more

than a dozen companies had filed petitions, and others were still coming in. Companies filing petitions include: Atlantic Refining Co., Crown Central Petroleum Corp., Danaho Refining Co., Sinclair Oil Corp., Socony Mobil Oil Co., South Hampton Co., Trigon Distributors, Inc., of Atlanta, Ga., Ingram Oil and Refining Co., Gabriel Oil Co., and Texas Asphalt & Refining Co.

The new round of appeals seems to be based on the theory that "hope springs eternal" as the record of past actions of the board indicates very few petitions are granted.

For the first half of this year, 54 appeals were filed, asking more than 350,000 bbls. daily more oil imports. Two were granted (Gabriel and Texas Asphalt), 47 were denied, and five are still to be decided.

Last week, the OIAB turned down six more appeals for more oil in the first half, five of them seeking to bring in more products and one crude.

Residual stock levels increased during May

RESIDUAL-FUEL stocks showed a seasonal gain in May, but are still well below stock levels at the same time a year ago.

Interior Department figures released last week showed East Coast nonbonded stocks were 13,310,288 bbl. At the end of May 1959 they were 20,108,900 bbl.

The difference was partially offset by the fact that bonded stocks at the end of May were 4,056,000 bbl., well above the year-ago level of 1,279,600.

The Interior report also revealed that 9,242,667 bbl. of residual were imported into Districts 1-4 during May, leaving 8,377,818 bbl. for import during June—the final month of the current allocation period.

Dealer status cloudy in pending-wage law

LESSEE gasoline dealers throughout the nation still do not know whether they will be covered by the extension of the wage-hour law which Congress currently is considering.

Unless this point is cleared up by Congress before final action on the legislation, chances are that the courts will have to make that decision eventually.

As the measure left the House Education and Labor Committee, it provided an exemption for retailers with sales of less than $1-million a year.

watching WASHINGTON

Clyde La Motte

• FPC may make decisions on key issues soon . . .

THE FEDERAL POWER COMMISSION likely will announce in the very near future some key decisions affecting natural-gas regulation, thereby setting a pattern for action in many other cases.

A ruling on the Phillips case, and perhaps on one or two others, may be handed down before the FPC staff takes its August recess. (The commissioners themselves do not plan on taking an August break.)

This was revealed last week by William R. Connole as he put on his hat to leave the commission. His term expired June 22.

Connole said the commission had been "working very hard" on several key cases—including Phillips—and that standards set in them should make possible the settlement of numerous pending cases.

He said many companies had indicated a willingness to settle cases, rather than drag them through lengthy hearings, but up to now have been reluctant to do so because of the uncertainty over how the FPC might rule on major issues.

But, he predicted, much of this reluctance would disappear if and when clear-cut standards are announced.

Furthermore, the establishment of some general standards would enable the commission to handle cases with more dispatch.

Connole said the commission is acutely aware of the need for prompt action in shaping up meaningful standards for the industry to follow.

• If FPC doesn't act, then Congress should do so . . .

UNLESS THE FPC is able to make substantial progress toward clarifying its gas regulatory policy within a year, the industry would be entirely justified in seeking congressional action to break the log jam, Connole said.

"I personally would support a drive for such legislation," he added.

However, Connole is optimistic. He feels that the upcoming action by the FPC may remove much of the need for such legislation.

He conceded that the commission has about reached the stage where it must shoot or give up the gun. But he said the outlook is not nearly as hopeless as it may seem to outsiders.

"The commission's thinking is firming up and some key formulas are nearing completion," he said.

The commission had hoped, almost up to the eve of Connole's departure, to get the Phillips case decision out before Connole's term expired. When it failed to do that, it set a new target date of no later than the end of July—and earlier if possible.

While Connole may be justified in his seeming optimism that a breakthrough lies just ahead, most people in the gas industry will believe it only when they see it. This is particularly true of those companies who have had cases kicking around in the commission for years.

• Connole leaves quietly, taking no pot shots . . .

ALTHOUGH CONNOLE has frequently dissented with the commission majority, his attitude on departure was largely complimentary of the other commissioners.

He readily admitted that the commission has been indecisive and slow in charting a regulatory course for the industry, thus creating a terrifying backlog of cases. But he points out that some of this delay was unavoidable and some was not of its own making.

For example, he cited the fact that producing companies added to the delay by their long fight to avoid federal regulation in the first place. He thinks they had a perfect right to wage such a fight, but this does not change the fact that it helped create more delay.

And so ended the FPC career of William R. Connole, who had become something of a controversial figure.

This would seem to exempt most gasoline dealers.

However, as currently worded, the legislation apparently combines the refiner and the retailer in applying the $1-million yardstick. If so, then few if any dealers would be exempt.

Some proponents of the legislation say that is not the intent of the bill, but thus far there has been no change in language to make that certain.

Since most dealers already pay higher wages than the proposed minimums, they aren't as concerned with that aspect as they are with the fact that they would be required to pay time-and-a-half for overtime.

Support for the passage of the extended coverage of the wage-hour law has been gaining recently, particularly since introduction of a compromise which would spread the hike to $1.25 an hour over 3 years.

FTC says it needs more men, not more laws

THE FEDERAL TRADE Commission wants more enforcement personnel, not more laws, to crack down on gasoline and other price discriminations.

"One of the best ways to stop a price war is to get an investigator into the field," says FTC Chairman Earl W. Kintner.

"The investigator goes in and the price war stops. I wish we could do that in every case."

Kintner foresees "a tremendous effort" in the remainder of this year by the FTC to crack down on Robinson-Patman Act violations (price discriminations). He says the FTC has appealed to businessmen to live within the law, but that the appeals have been largely ignored by them.

The FTC is due to get 50 more investigators in coming months under its new budget and expects to ask for still more next year.

The stepped-up enforcement, Kintner feels, will provide the commission's answer to the problem of "loss leader" or "below cost" sales.

He gave his views in opposing "loss leader" legislation which is being backed by some gasoline dealers, dairy men and other small business groups. He said such legislation would be confusing and would take away certain of the FTC's present power to act against price discriminations.

In addition to the FTC, the Department of Justice, Department of Commerce and the Budget Bureau are also opposing the legislation aimed at outlawing "loss leader" price cuts.

Nixon on Oil

- Continue Percentage Depletion
- Ease Control of Gas Producers
- Go Slow on Crude Import Cuts

VICE PRESIDENT Richard M. Nixon has placed himself firmly on the side of the oil industry on two top issues: Percentage depletion and natural-gas legislation.

Appearing in Houston, Nixon admitted frankly he would get more votes nationwide if he were against both propositions. But he said he would not take the political way out.

Nixon was asked at a meeting of the Texas Press Association: Would he retain the 27½% oil depletion provision and would he support the Harris gas bill?

Nixon's reply:

"The best political answer . . . would be against both of those proposals and especially as far as the depletion allowance is concerned, at least a very substantial modification.

"That is the political answer. I refuse to give it because, coming as I do from California, knowing something about oil exploration, and knowing something about the problems of a necessity for encouraging production in the natural gas area as the way in the long run to get gas to the consumers in the most efficient way at the cheapest prices, may I say that my answer to both of those questions is:

"I am for the 27½% depletion allowance, voting for it as I have previously in the Congress and in the Senate of the United States. I voted for the Harris natural gas bill and I believe that the principle of that bill is sound and I continue to support it."

Nixon was not asked specifically whether he would, if president, actively advocate natural-gas legislation. His answer that he would "support" such a bill may place him in the same category as President Eisenhower, who favors it but has not pushed it.

Nixon gave the Texas audience less satisfaction on his attitude toward reducing foreign crude imports. His chief concern, he said, is the effect of any such plan on this nation's relationships with other countries. His statement:

"I do know the difficulties that have been presented to the oil producers in Texas.

"But we have a problem of balancing the domestic interests of the United States against our foreign commitments. I don't think anybody in this room wants the President or this nation to adopt a policy that might be disastrous as far as our relations to other oil producing countries are concerned.

"I can assure you that when the mandatory import or quota system was adopted that the reactions in other parts of the world were difficult to handle. Any change in that quota system, and I want to be completely honest with you on this, would have certainly to be balanced against the reactions that would occur among

friends of the United States who might be affected.

"I do not know any changes that are currently contemplated. I do know that the problem has been brought very forcibly to the attention of those who have responsibility for it. For me to hold out hope, or for me to make a promise, or for me to indicate a position that would be, for sure, very popular for this audience, would be completely irresponsible for me in the position that I hold."

Finest in the 1000 lb. working pressure range

This **new** 1000 wp. Tubing Head is safe, compact and economical.

1. 2000 psi Test—1000# psi Working Pressure.
2. The Top Nut contains three hammer-up lugs with ample striking surface and tong space. The hammer-up lugs are positioned to facilitate use of automatic slips.
3. The Type "K" Body has a 7⅝" OD 8 RD casing thread on top for the installation of valves or other equipment.
4. The Type "K" Body is furnished with two heavy 2" integrally formed side ports which are leak-proof.
5. The Top Packing Ring is cast by a precision process which provides two perfect halves. When assembled there is virtually no split through which rubber can flow.
6. The Top Packing Element is of Hycar and is the best, most oil and gas resistant compound available for such service. Also, it is newly designed for ease of installation and requires the minimum of make-up to provide a pressure-tight seal.
7. The Top Nut and Slip Bowl will accommodate all sizes of slips interchangeably, 1" through 3".
8. All parts in the Type "K" Head are identified as to Type, Size and where necessary, the Presure Rating.
9. The Larkin Type "K" Tubing Head is compact, 10¼" overall, and is available with either male or female casing threads, 4½" through 7". The Type "SK" has an overall length of 14½".
10. Mandrel suspension with all the Type "K" quality is available in the Type "MK" Tubing Head.

The Larkin "K" Series Tubing Heads safely and efficiently help you effect **economies** in the 1000 lb. working pressure range. It is an important new addition for this service.

All Larkin Tubing Heads and Casing Heads are available . . . "Through Your Supply Store." Interchangeable parts are immediately available from the Larkin warehouse system which blankets the oil country.

LARKIN PACKER COMPANY
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WAXAHACHIE, TEXAS
LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

LARKIN
...Through Your Supply Store

Here's where 1,469 new jets are headed

Type	1959	1960	1961	1962	1963	Total
Medium and long-range Pure jets:						
U. S.	86	149	67	16	0	318
Foreign	51	145	65	0	59	320
Long-range turboprops:						
U. S.	104	34	17	0	0	155
Foreign	73	44	12	3	0	132
Medium-range turboprops:						
U. S.	122	17	0	0	0	139
Foreign	337	39	29	0	0	405
All types:						
U. S.	312	200	84	16	0	612
Foreign	461	228	106	3	59	857
Grand totals	773	428	190	19	59	1,469

Commercial Jets Are Climbing

. . . And each new full-jet plane is adding about 6 million gallons a year to the rapidly expanding jet-fuel demand.

COMMERCIAL JET-FUEL demand should skyrocket this year. Scheduled deliveries in 1960 will raise the total of turbine-powered commercial planes by more than 55%. And almost 70% of this year's deliveries will be the fuel-gulping full jets.

Here's a rule-of-thumb jet people use to estimate fuel requirements: A four-engined plane like the Boeing 707 will consume 2,000 gals. per hour, it will fly 10 hours a day, 300 days a year. Result: 6,000,000 gals. per plane per year.

The number of pure jets scheduled for delivery this year is 294, thus adding 1.7-billion gallons to annual jet fuel demand. That compares with 137 jet planes in operation at the end of 1959. It's an increase of more than 200%. All pure jets to be delivered in 1960 are four-engine planes except for 32 of the two-engine French Sud Caravelles.

There will be twice as many pure jets as turboprops delivered this year, the first time that jets have exceeded turboprops since turbine-powered planes began coming off the lines. The accent will continue on the jets, too, in succeeding years.

These figures are contained in the annual survey made by Esso Export Corporation's Aviation Department. The survey points out that jets have been ordered by 49 airlines representing 30 countries in all six continents.

Turboprops, too . . . Turboprops, the transition aircraft of the jet age, still dominate the turbine-power field.

There were 636 in operation at the end of 1959 and 134 more due for delivery this year. There are indications that the turboprop is being phased out. Fifty eight are on the books for 1961 delivery, three for 1962, and none for 1963.

Long-range transports lead by a good margin in the pure-jet category but shorter haul planes are catching up fast. The survey points out that while there are 312 Boeing 707's and Douglas DC-8's in service or on order, there are almost 300 shorter-range jets delivered or coming.

Middle-range Comets, Convair 600/880's, Boeing 720's and DeHaviland 121's account for more than 200 orders and Caravelles, the only short-range jets in the field, for 80 more.

Fuel economy . . . Thirty six of the Boing 707's being taken by American Airlines will have JTD3 turbofan engines installed eventually. This device is credited with bettering fuel economy, one of the critical factors in jet operation.

Economic operation is important because of the vast sums involved. The survey estimates that total investment in aircraft orders placed for delivery in 1959 through 1964 amounts to nearly four billion dollars.

Town-Lot Strike

. . . in Los Angeles flows 37° crude at a daily rate of 1,200 bbl.

LOS ANGELES' town-lot drilling got a shot in the arm last week with the report of a 1,200-bbl.-daily discovery.

Union Oil Co. and Signal Oil & Gas Co. report their Union-Signal PE 3 flowed at the rate of 1,200 bbl. daily through a 26/64-in. choke. The crude is 37° gravity. The wildcat is on the northwest corner of the intersection of Pico Boulevard and La Brea Avenue, about 5 miles west of the downtown business district. The field has been named Las Cienegas.

The producing formation was not revealed, but the flow is from a zone between 5,000 and 5,300 ft. The operator set 7-in. casing to 5,500 ft.

Union, the operator, says electric logs of two other wells drilled in the field indicate they also are productive. The soundproofed rig has been skidded a few feet and a fourth well spudded. The drillsite is the barns of the old Pacific Electric Co.

The two companies hold leases on approximately 7,000 acres surrounding the discovery well. These leases were signed by almost 25,000 home owners. Union holds 60% of the operation and Signal 40%.

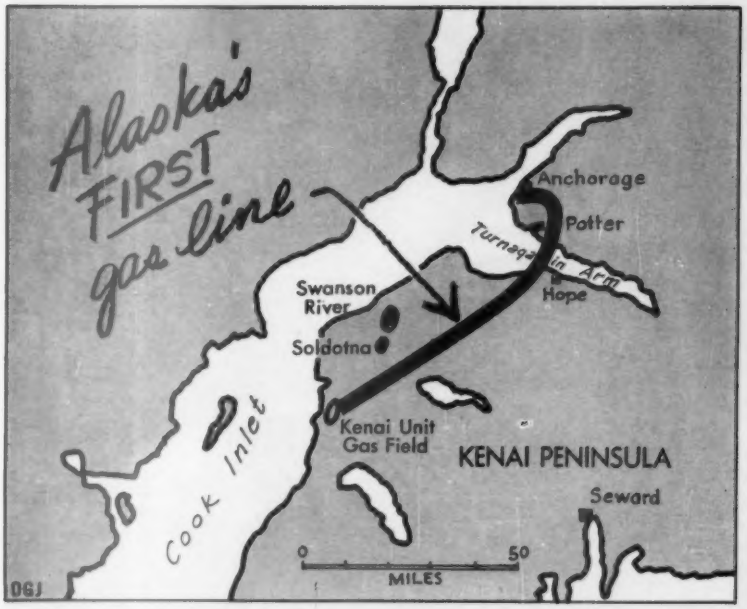
The discovery, in SW SW Sec. 27-1s-14w, is about a mile south of the east flank of old Salt Lake field, which produces from about 1,900 ft.

PROCESSING

Texaco will place three new units on stream this week at its 60,000-bbl. Wilmington refinery in Los Angeles. Included are a 12,000-bbl. Platformer, a 12,000-bbl. Hydrotreater, and a 26,000-bbl. fractionation unit. The cat reforming unit will boost the refinery's cat reformer capacity to 22,000 bbl. daily. Bechtel Corp. built the new units.

A $325,000 administration building is to be constructed at the Toledo refinery of Standard Oil Co. (Ohio). Completion is expected this fall.

A 2.6% increase in prices of Du Pont's tetraethyl lead antiknock compounds, necessitated by higher production costs, becomes effective July 20. Motor Mix is hiked from 35.08 to 35.99 cents a pound and Aviation Mix



Goal: Anchorage by October

... in time for the heating season. Contracts readied for construction, which includes a rugged water crossing.

ALASKA'S FIRST natural-gas pipeline serving Anchorage from the Kenai peninsula will make an 8½-mile crossing of Turnagain Arm, where 35-ft. tides create a variance in water depth from 40 ft. to 75 ft.

Contracts on the project, which makes use of Alaska's first commercial gas production, are being drawn for signing this week with Williams Brothers Co. and Sharman, Allen, Gay & Taylor, Inc.

Delta Engineering Co., agent for Alaska Pipeline Co., is awarding the contracts. The line should be completed by October in time for the winter heating season.

Williams Brothers will construct 74 land miles of 12¾-in. o.d. line from Kenai Unit gas field to Anchorage, while SAGT will handle the water crossing with dual 12¾-in. lines. The dual lines will have ½-in. wall pipe and 2 in. of concrete covering.

Delta shortly will award a contract for 45 miles of 2 to 12-in. distribution lines in the Anchorage area.

The company . . . Alaska Pipe Line Co. is a newly incorporated company with the same Texas and California owners who organized Natural Gas Corp. (OGJ, Oct. 26, 1959, p. 55.)

Alaska Pipe will build and operate the transmission lines, and its subsidiary, Anchorage Natural Gas Corp. will build and operate the distribution system. Robert B. Baldwin, president of the old Anchorage Gas Corp., is president of both new companies.

The Baldwin group moved in quickly last year after Union Oil Co. of California and Ohio Oil Co. made their joint gas discovery on Kenai and sewed up a 20-year contract for the production. The group already had applied for and later obtained franchise rights at Anchorage with the intention of using manufactured gas from the West Coast.

Total cost of the transmission line will be about $12.8 million. SAGT's proposed installation contract for the crossing will cost about $3.5-million and Williams Brothers, $2 million.

Union-Ohio have completed three gas wells in the Kenai unit gas field, and these will furnish sufficient gas to fill the current needs of the Anchorage area. The line itself will have a capacity of 71-million cubic feet daily.

BRIEFS . . .

from 38.69 to 39.69 a pound. The price changes wipe out about one-half a reduction put in effect last January.

California Oil Co., has purchased its distributor in Portland, Me., effective June 30 and will operate under the distributor's name, Community Oil Co. Inc. Community serves Chevron service stations in Maine and New Hampshire and distributes kerosine, heating and fuel oil.

Synthetic-rubber consumption will hit 1,120,000 long tons this year, up 4.5% from last year's record high, according to J. W. Keener, president of B. F. Goodrich Co.

A new Hydrodealkylation unit, to cost more than $1 million and produce benzene for manufacture of plastic products, will be built by Suntide Refining Co. at its Corpus Christi, Tex. refinery. Construction will begin in August with completion planned early in 1961.

Mobil Chemical Co. has been organized by Socony Mobil Oil Co., Inc. to handle the company's petrochemical activities in the U. S. and abroad. It will make and sell new products, will handle Socony Mobil's petroleum additive business, operate the world's largest high purity ethylene plant under construction at Beaumont, Tex., and Socony's paint plants at Beaumont, Los Angeles and Metuchen, N. J.

Sinclair Refining Co. will add an orthoxylene unit to its Houston refinery to produce 66,000,000 lb. per year to fulfill a contract between Sinclair Petrochemicals, Inc., and a Japanese chemical group.

Also for Refiners . . .

IN THE NEWS: Another round of import-quota appeals filed with OIAB (p. 86) . . . Residual-fuel stocks increased in May, but are still below last year's levels (p. 87) . . . Commercial jet-fuel demand should skyrocket this year (p. 90) . . . Russia's big pipeline will pave way for processing expansion in the satellites (p. 94) . . . Growing Japanese polyethylene demand attracts two ventures (p. 95) . . . Venezuela urges Castro not to be too hasty in refinery action (p. 95).

PLUS THESE TECHNICAL REPORTS: Using control computers for petroleum processing (p. 116) . . . Finding multiphase-flow answers (p. 133).

Terminal for Two

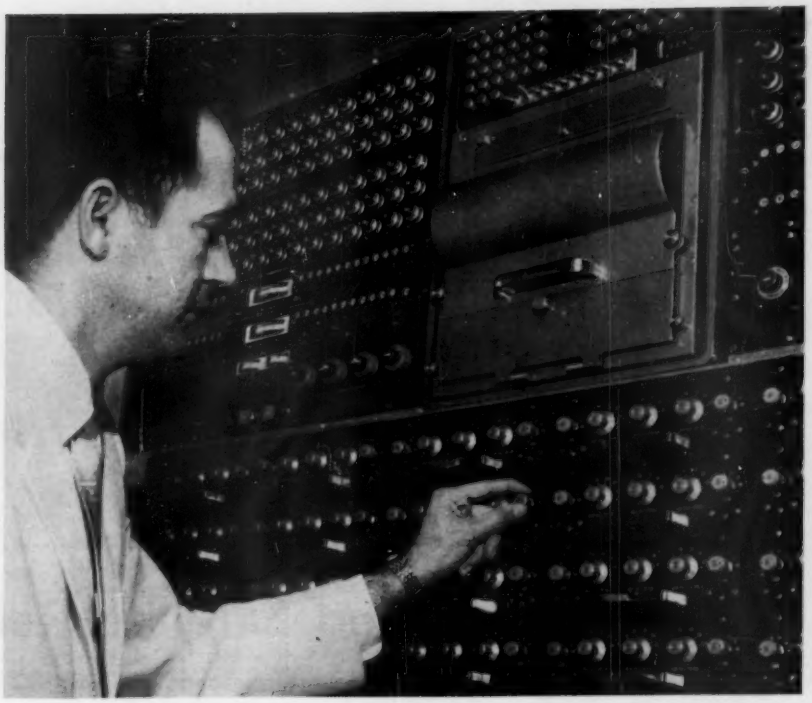
WITH THE ADVENT of the supertankers, many companies faced the problem of a lack of deep-water facilities near established refineries. Shell Refining Co. solved this at Liverpool with a new terminal that can unload two 65,000-ton tankers at once. Even larger ships could tie up if not fully loaded. Crude from terminal is moved 9 miles by pipeline to Shell's Stanlow refinery.

Now It's 42-In.

TWO GAS-PIPELINE firms are considering using 42-in. pipe in cross-country lines. So Bethlehem Steel Co. has produced that size to API 5LX 52 specifications. The first joints have been sent to two manufacturers who are developing bending machines for use on right-of-way. The machines will be finished this year. The largest diameter high-strength pipe regularly produced for trunk lines is 36 in.

Seismic Work Rolling Along

SINCLAIR Oil & Gas Co. had such success with an experimental 48-trace seismic recording truck it has now sent a second such truck into the field. Advantages: greater subsurface coverage with fewer shot points, better records, and lower drilling costs. This truck, like its predecessor, was designed and built by Sinclair Research Laboratories, Inc.



New Turbine Use

LABORATORY tests of a gas-turbine engine which may be used as a new power source for mobile fracturing units got under way last week. Halliburton Oil Well Cementing Co. plans to test it under simulated field conditions, then in field service. The project, if successful, may mean better over-all frac treatments (OGJ, Feb. 22, p. 76). The engine is General Electric's Model 720—a 300-lb., 900-hp. commercial version of a helicopter power plant. The available horsepower—one of the big factors in hydraulic fracturing—is said to increase by more than half that of conventional diesel and gasoline power sources.

Soviet Line to Feed Satellite Refineries

• Big-inch system is expected to carry 300,000 bbl. daily of Second Baku crude by 1965. It will open the way for a large refining and petrochemical expansion planned in Russian-controlled countries of eastern Europe.

THE RUSSIAN pipeline system snaking into eastern Europe is rapidly shaping up as one of the biggest pipeline projects in the world today.

Under a revised and expanded program, the system will now stretch for 2,800 miles from Russian oil fields east of the Volga River to a chain of refineries under construction in Poland, East Germany, Czechoslovakia, and Hungary.

The Council for Mutual Economic Aid (Vomecon) pipeline will carry 15 million tons of crude, or 300,000 bbl. daily, by 1965. The system will open the way for an enormous expansion planned in eastern Europe. It will eventually change the entire industrial face of the region. At the same time, it will give Russia a tighter economic grip over the four satellite countries.

The Vomecon system is of added significance because of a severe oil shortage in the terminal countries. Combined production of all four last year was only 26,000 bbl. daily. Polish fields supplied only 9 to 10% of local needs. Czechoslovakia satisfied 5 to 6% of its demand. East German output was virtually nil. Hungary, with 20,000 bbl. daily domestic crude production, was better off, but it still uses relatively little oil.

Imports of the four countries are rising. But they totalled only 140,000 bbl. daily last year, up from a meager 20,000 bbl. daily in 1950.

Russia, in touting the Vomecon project, emphasizes that all four countries are conspicuous for under-consumption of oil. It says that in the 1954-55 period, oil accounted for 4% of the fuel consumed in Poland, 3.5% in Czechoslovakia, 1.4% in East Germany, and 12.6% in Hungary. Western Europe in the same period used oil for 17.1% of its fuel, while the world on the whole averaged 27.7%.

The Vomecon line will give the satellites direct access to "Second Baku" oil fields in the Volga-Ural region. These account for four-fifths of Soviet reserves, and two-thirds of its production.

The line will run westward from the Kuibyshev area to Mozyr, Russia, where it will divide into two branches. The northern arm will extend into Poland and East Germany. The southern branch will be laid into Czechoslovakia, with a feeder extending southward into Hungary.

Each country is building the section of line within its borders, and the system is scheduled to be in partial operation in 1963. Diameter has not been disclosed, but there have been published reports that the big-inch pipe will be "the largest in the world."

Construction is in progress at several points. Here is a rundown:

Poland . . . About 450 miles being laid on Polish territory. Because a larger diameter pipe will be needed to handle supplies destined for East Germany, that country is partially financing the Polish section and is granting the country a 10-year loan.

A 40,000-bbl. refinery at Plock, northwest of Warsaw, will be completed in 1964. Soon after the refinery goes on stream, an adjacent petrochemical plant will start producing raw materials for plastics, artificial fibers, and synthetic rubber.

Polish planners expect to add an additional 80,000 bbl. daily capacity by 1967. This will be followed by construction of a second petrochemical plant. In contrast to the 120,000-bbl. plant at Plock, the country's existing five refineries have a combined capacity of 16,000 bbl.

East Germany . . . The line will cover only a few miles of East German territory, extending to a refinery at Schwedt, on the Oder River. Refinery construction started last year on a plant that will have an ultimate capacity of 100,000 bbl. This will bring the country's total capacity to about 160,000 bbl.

Czechoslovakia . . . Construction of

this 250-mile section started last fall, but work has been hampered by breakdowns of trenching equipment. The schedule still calls for opening of this branch by the end of 1961.

Most of the oil will be delivered to a refinery under construction at Bratislava, on the Danube River. Remaining Czech supplies will be taken off at refineries at Brno, Pardubice, Kolin, and Kralupy. An extension will serve a petrochemical plant at Most, near the East German border.

The deputy director of the Slovnaft Works at Bratislava, said after a tour of the U. S., that the new Czech installation "will be technically superior to modern U. S. plants." The plant is being built with Russian technical help, and will supply feedstocks for petrochemical production.

A Prague foreign trade paper says the Russians will price crude sold in Czechoslovakia on world market prices, plus 50% of the average transportation cost for crude shipped from the Middle East to Hamburg.

Hungary . . . An 80-mile spur is being laid southward from Czechoslovakia to Szazhalombatta, a town 17 miles south of Budapest (OGJ, June 20, p. 96). Hungarian reports place the planned capacity at 60,000 bbl. But information from Russia indicates the first stage will be only 20,000 bbl.

Hungary will build a 19-mile extension from Szazhalombatta to an existing pipeline system carrying crude from local fields to a refinery at Szony. This will enable the Szony plant to run either local or Russian crude.

Grand Cayman Test Planned

Harry T. McClain, president of United States Sulphur Corp., Houston, says his company will spud in July the first of four wells on the Island of Grand Cayman, northwest of Jamaica.

McClain and E. D. Merren of Georgetown, British West Indies, obtained an exploration license for all of Grand Cayman from the British Governor of Jamaica.

The license requires that four wells or 10,000 ft. of hole be drilled within 2 years. Two-year renewals are allowed if the same conditions are met.

The tests will go to the upper Cretaceous between 3,500 ft. and 5,000 ft. The first will be located on the northwest corner of the 22-mile by 9-mile island.

Two recent shallow wells have been drilled on the island. One was abandoned at 1,317 ft. and the other at 541 ft. when the drill bit was lost in the hole.

Japan Needs Polyethylene

. . . so two joint Japanese-American ventures are launched to build new units; other firms are planning expansions.

GROWING DEMAND for polyethylene in Japan has attracted two new joint Japanese-American ventures.

One new company is being set up by Mitsui Petrochemical and Du Pont, and another by Nitto Chemical and Union Carbide. Both groups plan high pressure-type polyethylene plants with design capacities of 27,000 tons per year.

Demand for polyethylene is soaring. Consumption last year was 54,533 tons, with 21,280 tons produced locally. Demand is expected to grow to 114,000 tons by 1963.

Mitsui Petrochemical and Du Pont are seeking authorization from the Japanese Government to establish a company capitalized at $8 million, consisting of $4 million in cash from Mitsui, and $4 million in technical help from Du Pont.

A $14 million polyethylene plant will be built at Ohtake, Hiroshima Perfecture. It is scheduled to go on stream early in 1962. Mitsui for 2 years has operated a 12,000 tons per year plant at Iwakuni in the same prefecture. But output has been as low as 50% of capacity because of poor demand for polyethylene produced by the low-pressure Ziegler process.

Nitto Chemical and Union Carbide plan to call their joint company Nitto-Unicar. They expect to open their plant at Kawasaki early in 1962. Toa Nenryo Kogyo will supply up to 30,000 tons per year of ethylene from a third refinery and petrochemical project now in the planning stage.

Initial capital of Nitto-Unicar will be $6 million, to be increased to $10 million later. Nitto Chemical will supply $5 million cash. Union Carbide will furnish $3 million in technical know-how, and $2 million in polyethylene product.

Other producers . . . Total polyethylene capacity at present is 52,000 tons per year. Three of the established producers plan major expansion programs of their own. Sumitomo will increase its capacity to 26,000 tons per year by the end of 1961. Mitsubishi will expand to 25,000 tons by mid-1961, and Showa will expand to 20,000 tons by 1962.

Perez Warns Fidel: Don't Be Too Hasty

VENEZUELA last week warned Cuba not to count on Venezuelan oil in the future if she takes over the three major refineries now processing Venezuelan crude.

In an abrupt about-face, Dr. Juan Pablo Perez Alfonzo told a Caracas press conference last week he recommends Cuba come to an agreement with the refiners that won't peril the country's oil supply.

The three refiners, Esso, Texaco, and Royal Dutch - Shell, refused a Cuban "offer" of 10,000 bbl. daily each of Russian crude oil. The companies pointed out they preferred to stay with traditional Venezuelan suppliers, in each case an affiliated company.

Fidel Castro countered with thinly veiled threats that the companies would have to take "the consequences" unless they reconsider.

It was this threat that apparently triggered the Venezuelan minister's public statement. He emphasized that Venezuela would make no diplomatic representations with regard to the situation.

Venezuela will, he said, take all the measures necessary for the defense of its economy.

Dr. Perez Alfonzo pointed out that the 70,000 bbl. daily which Venezuela has been supplying Cuba represents 3.19% of his country's oil exports.

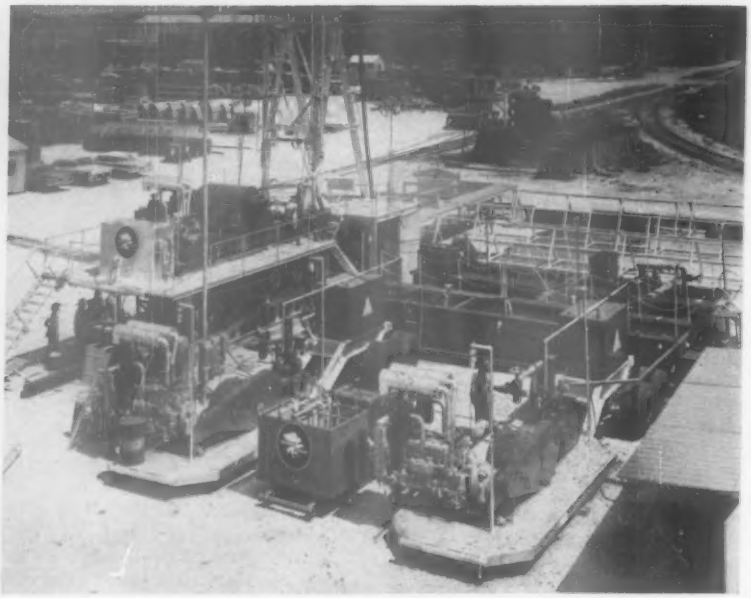
If Cuba turns to the Russians for its crude supply, Venezuela will have to make other dispositions of its oil, the minister said, and "if, in the future, Cuba will need Venezuelan oil again, it is possible that the new dispositions made by Venezuela in defense of its economy would not permit any change."

In a somewhat milder tone, the minister continued:

"This ratification of policy is in relation to the situation in Cuba. In the concrete case of this magnificant client, which ranks eighth in our exports, our position is that an understanding between that government and the refineries there which refine oil from our country is desirable."

He added, with reference to current British-Soviet oil trade discussions: "It is also our desire that negotiations . . . not result in a reduction in the market we have in Great Britain."

DESERT RIG is readied for Spanish Sahara in Continental - Emsco yard at Houston.



FEATURES of the rig assembled for Falcon-Seaboard include trailer-mounted draw works and mud pumps; cementing unit, and mast trailer.

Rig to Test Spanish Sahara

- **Falcon-Seaboard will ship its new, highly portable rig this week to test this virgin North African area for Gulf.**

GULF OIL Corp. and Spanish-owned CEPSA plan to test the unknown sands of the Spanish Sahara in late July.

Gulf, the operator, has signed an 18-month contract with Falcon-Seaboard Drilling Co., Tulsa, to drill a series of stratigraphic holes.

Falcon-Seaboard has readied a portable Continental-Emsco rig at Houston for shipment to the Canary Islands by freighter and then by landing craft to the desolate Spanish Sahara seacoast. Drilling will commence in one of Gulf-CEPSA's two coastal concessions. The group has three others further inland.

Encouraged by striking successes in other arid areas of North Africa, most U. S. oil companies joined in the bidding for Spanish Sahara concessions offered by Spain earlier this year (OGJ, Feb. 15, p. 78, and Mar. 21, p. 93). Gulf-CEPSA won Blocks 47 and 51 along the coast and 9, 10, and 16 to the northeast.

None of the concessions has ever been drilled, and there has been little seismic work.

Drilling plans . . . Falcon-Seaboard, which is going into the Eastern Hemisphere for the first time, is spending $915,000 for a portable desert rig, equipment, and camping facilities.

Officials of the company said they do not know where they will spud the first well except that it will be in either Block 47 or 51 near the coast.

The company hopes to sink up to 10 holes of the 2,000-5,000-ft. variety per month to provide Gulf with necessary geological information on the untried remote area.

The contractor expects to average 1,200 ft. every 1 or 1½ days. The highly portable and unitized rig will be able to move over the roadless terrain to new drilling sites with sufficient facility to drill many holes in a short time.

The drillers plan a program of 15-in. hole with 10¾-in. casing, 9⅞-in. hole with 7⅝-in. casing, and 6¾-in. hole with 4½-in. casing. The rig is capable of going to 7,000 or 8,000 ft. but probably will go no deeper than 5,000 ft.

All the physical equipment of the Falcon-Seaboard operation has been assembled at the Continental - Emsco plant in Houston. The freighter Monterey will move from Houston with the entire load this week. It will dock 2 or 3 weeks later at Las Palmas on Gran Canaria Island.

Rig features . . . The Spanish Sahara is famous for its lack of water. For that reason, Falcon - Seaboard has equipped its new rig to drill with air. If the holes can be drilled with air, much less water will be needed than for drilling with water-base mud.

The air-drilling equipment was assembled in the Midland, Tex., yard of Technical Drilling Services, Inc. Included are four skid-mounted engine-compressor sets and one engine-booster set. There is also an injector to add foamers and the like to the air stream.

Because portability is so important in the operation, each rig unit has its own engine drive; there are no long and complicated chain drives. The draw works has its own GM twin G-71 diesel engine and each of the trailer - mounted pumps has its own engine. In all, there are eight twin diesels and eight single engines as well. None of these need be disconnected from its driven load during a move.

When the mud trailers are set in place after a move, the trailer beds sit flat on the ground with the wheels suspended in the air. Thus, the pumps have a solid vibration-free foundation when running. No jacks are necessary to lift the wheels from the ground.

Draw works is a Continental-Emsco GB-250 with sand reel, auxiliary brake, and torque-converter drive. The mast is a CE T-97 which travels and operates on dual trailers. Nominal gross capacity of the mast is 350,-000 lb.

Where Rigs Are Running Abroad

	June 1960	Mar. 1960	Aug. 1959
Latin America			
Argentina	106	101	88
Bolivia	10	9	11
Brazil	48	42	24
Brit. Honduras	...	...	1
Colombia	19	22	28
Chile	4	5	5
Cuba	1	1	1
Ecuador	3	5	6
Guatemala	1	2	3
Mexico	134	134	120
Paraguay	...	...	...
Peru	11	9	4
Trinidad	28	31	31
Venezuela	42	50	61
TOTAL	407	411	383
Middle East			
Iran	16	13	10
Iraq	11	14	8
Israel	6	4	4
Jordan	...	...	1
Kuwait	2	2	3
N. Z.	6	5	4
Qatar	2	2	1
Saudi Arabia	3	3	6
South. Arabia	2	3	3
Syria	2	2	2
Turkey	8	8	5
TOTAL	58	56	47
Western Europe			
Austria	19	19	19
France	50	50	57
West Germany	100	100	127
Italy	36	36	36
Netherlands	4	4	3
Spain	8	8	8
United Kingdom	7	5	5
TOTAL	224	222	255
Africa			
Algeria	53	45	40
Angola	3	3	2
Brit. Som.	...	...	...
Egypt	5	5	5
Fr. Eq. Africa	6	9	11
Fr. West Africa	3	5	2
Libya	32	31	15
Madagascar	2	2	3
Morocco	1	1	5
Nigeria	5	8	8
Somalia	2	2	2
Tanganyika	...	1	1
Tunisia	...	...	3
TOTAL	112	112	98
Asia-Pacific			
Australia	4	5	4
British Borneo	2	2	2
Burma	3	3	4
Formosa	1	1	1
India	6	6	5
Indonesia	15	15	15
New Guinea (inc. Papua)	1	1	1
New Zealand	...	1	1
Pakistan	5	5	6
Philippines	3	3	1
Timor	1	1	1
TOTAL	41	43	41
GRAND TOTAL	**842**	**844**	**824**

NOTE: Estimates made where complete up-to-date reports are lacking.

Foreign Drilling Rate Holds Near-Record Pace

- **Hot spots include Libya, where 32 rigs are active, and the Persian Gulf.**

At home, mild U. S. upswing offset by Canada's seasonal post-thaw slowdown.

ROTARY DRILLING outside the U. S. and Canada is keeping up the near-record pace reached earlier this year.

The latest count shows 842 rotary rigs making new hole, only two fewer than in March. The number of active rotaries in the U. S. increased 109 between mid-March and mid-June to 1,760. However, Canadian activity declined with the summer thaw. Only 165 outfits are operating north of the border, 70 fewer than 3 months ago.

Libya continues as one of the world's hottest drilling spots, with 32 rigs running, and others on the move. Oasis Oil has 11, Esso Libya 4, Esso Sirte 2, British Petroleum, Mobil, and Shell, 3 each, Amoseas, Gulf, and CPTL, 2 each.

Two American companies have an interest in active wildcat operations in the French Sahara, where a total of 53 rigs are cutting rock. CEP, in which Mobil Sahara has 25% interest, has bottomed its Ohanet 101 discovery in eastern Algeria below 8,300 ft. The well, located 350 miles south of the Mediterranean Coast, tested 1,900 bbl. daily of high-gravity crude through a 1-in. choke at about 7,740 ft. Substantial gas was found higher in the well.

A joint Cities Service-Prepa, Francarep venture has bottomed a well at Bou Aicha at 11,700 ft. Afropec Cities Service has 49% interest in the program.

Persian gulf . . . The Japanese-owned Arabian Oil Co. is adding a second rig to its offshore field off the Neutral Zone, and a third outfit may be ordered soon. Two 6,000-bbl.-daily wells have already been completed, and the Japanese are pressing a development drilling and terminal program.

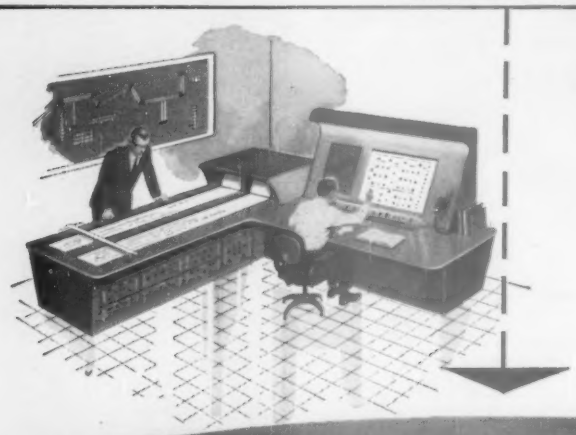
There are half dozen oth r wells under way from either mobile drilling barges or fixed platforms in the Persian Gulf. These include a development drilling program by BP and CFP at Umm Shaif field, wildcat drilling by Royal Dutch-Shell off Qatar, and delineation drilling at Manifa field by Aramco. Pan American International (Indiana Standard) is drilling ahead below 13,000 ft. in one test off Iran, and is making preparations for a second test. A joint Iranian-Italian company is drilling on an unconfirmed discovery in the northern corner of the gulf.

Despite the recent wave of concession grants in Australia, only one group of majors is currently drilling. WAPET, owned by Caltex, Royal Dutch, and Ampol, is drilling ahead at 5,722 ft. at Barlee 1, 32 miles north-northeast of Broome. The government's Bureau of Mineral Resources is drilling at 4,600 ft. in a strat test at Beagle Ridge north of Perth. Two other wells in the Roma and Brisbane areas are being drilled by local companies.

In Saudi Arabia, Aramco is drilling a delineation well at Abu Hadriya, a 20-year-old field that has never been commercially developed.

Sinclair Somal has completed its fifth dry hole on its concession in Somalia. The latest test, Duddumai 1, was taken below 11,000 ft.

Link Industrial Control Systems Engineering...



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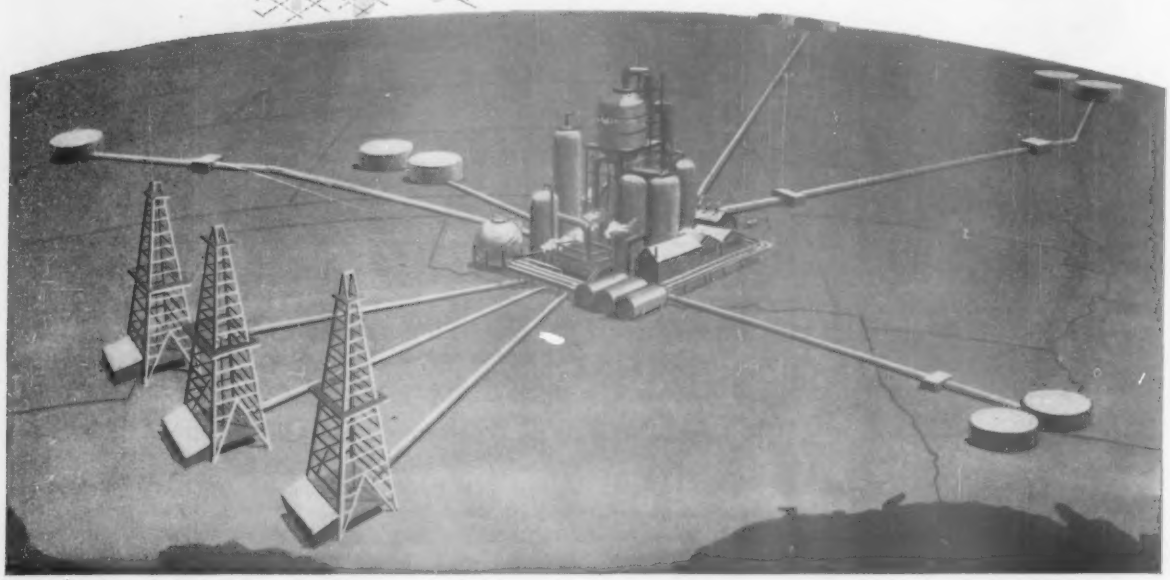

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For specific details on Link Dialog Pipe Line Simulators, write to J. C. Croft, Jr., Manager, Industrial Control Products, Link Division, General Precision Inc., Binghamton, N. Y

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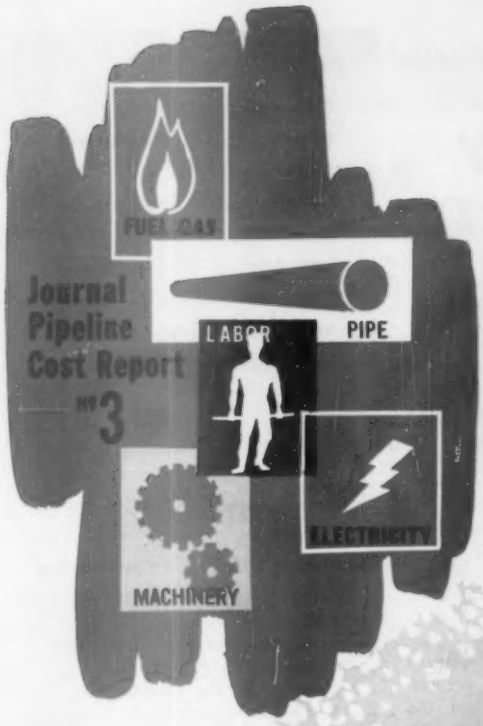
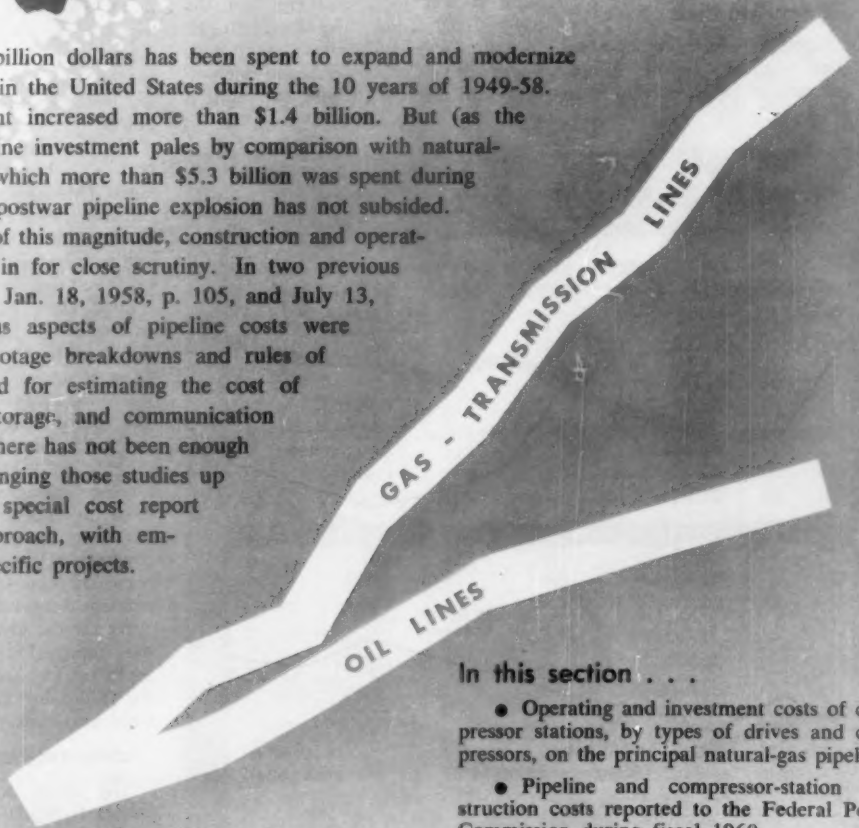


WHAT IT COSTS TO BUILD AND OPERATE GAS PIPELINES

BY GENE KINNEY
Assistant Pipeline Editor

MORE THAN 6¾ billion dollars has been spent to expand and modernize oil and gas pipelines in the United States during the 10 years of 1949-58. Oil-pipeline investment increased more than $1.4 billion. But (as the chart shows) oil-pipeline investment pales by comparison with natural-gas transmission, on which more than $5.3 billion was spent during the period. And the postwar pipeline explosion has not subsided. In a growth industry of this magnitude, construction and operating costs must come in for close scrutiny. In two previous special reports (OGJ, Jan. 18, 1958, p. 105, and July 13, 1959, p. 90), various aspects of pipeline costs were studied. Complete footage breakdowns and rules of thumb were presented for estimating the cost of pipelines, pumping, storage, and communication facilities. Since then there has not been enough change to warrant bringing those studies up to date. This third special cost report takes a different approach, with emphasis on costs of specific projects.



In this section . . .

- Operating and investment costs of compressor stations, by types of drives and compressors, on the principal natural-gas pipelines.
- Pipeline and compressor-station construction costs reported to the Federal Power Commission during fiscal 1960.
- Estimates of pipeline and compressor-station construction costs in the most active areas of the U. S. for projects now before FPC.

(This section perforated for convenience in filing.)

Costs vary by company and type of drive

A panoramic view of investment and operating costs, by types of drive, is presented for compressor stations on the principal U. S. gas pipelines. Investment figures are cumulative; operating figures are for 1958.

TIME and type of machinery have a tremendous effect on how much it costs to build and operate compressor stations on a gas-transmission line.

This is the story told in the table on the next page. It tells a story of inflation in materials costs on the one hand and of increased efficiency on the other. Generally speaking, the older systems are characterized by lower investment and higher operating costs; for the newer systems, the converse is true.

(For further comparison, current investment costs are examined in the next article of this special report.)

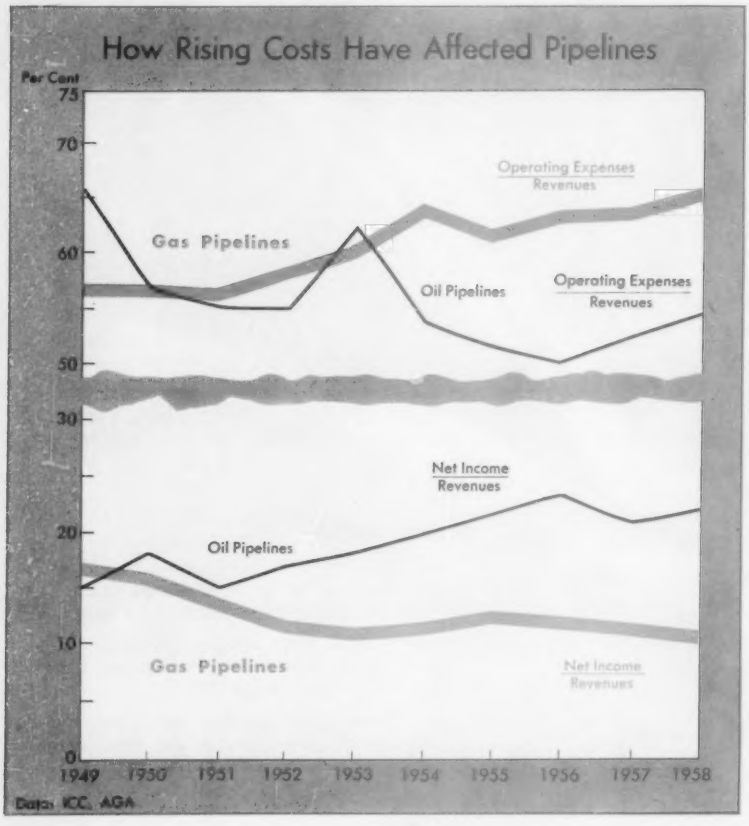
Investment Costs

On the pipelines whose horsepower was installed primarily before World War II, investment per horsepower is in the neighborhood of $200 for gas-engine reciprocating compressors. On postwar systems of this type, investment per horsepower is around $300, sometimes considerably more.

All of the centrifugal stations are of postwar vintage. Investment costs of these stations vary widely, as do costs for reciprocating stations, even if they are built during the same year. The influences of design, location, station size, and number of units can combine to cause wide fluctuations.

Usually, the cheapest type of installation from a first-cost standpoint is the electric-driven centrifugal; yet one such station reported here had the highest cost of any type of centrifugal.

There was only one system with engine-driven centrifugals and one system with a steam turbine, providing a representation too narrow for fair comparison.



Operating Costs, Fuel Consumption

Operating expenses associated with compressor stations, in dollars per installed horsepower, were tabulated to show the wide variation. The figures are distorted by the variations in load factor which are not shown. Load factors for the reporting companies ranged from 11 to 85; the systems with the poorest load factor generally had the least expenses per installed horsepower.

Fuel consumption per horsepower-hour was computed for all of the systems. This item was not tabulated because horsepower-hour figures were based on rated horsepower of all units, and many of course operated at partial load and burned gas with varying B.t.u. content. But the figures do show an interesting range that coincides with the known performance of various types of units.

Prewar reciprocating units generally had fuel consumption of 10 to 13½ cu. ft./hp.-hr. Postwar units had roughly 8 to 10 cu. ft./hp.-hr. Gas-turbine figures coincided closely with those of prewar reciprocating units. However, the newer units with higher combustion temperatures are known to burn less than 10 cu. ft./hp.-hr. when ambient temperature is low.

By far the lowest fuel consumption was reported for the engine-driven centrifugal system. It was less than 7 cu. ft./hp.-hr. based on operation at rated horsepower.

Costs Take Bigger Revenue Bite

The trend of total operating expenses is steadily upward at a faster rate than revenues are increasing. In the chart, the performance of gas pipelines is compared with oil pipelines. The increased efficiency of gas pipelines is masked by one component which is included in total operating

Compressor-Station Investment and Operating Data

RECIPROCATING STATIONS

Company	No. employes	Plant cost (thou. $)	Expenses (thou. $) Fuel or power	Other	Compr. fuel (M.M.c.f.)	Total hp.	Investment per hp. ($)	No. driving units	No. compr. units	Expenses per hp. ($)	No. stations	Year installed
1	9	1,795	9	16	24	4,000	449	2	4	6.31	1	1958
2	97	15,349	396	800	2,017	58,000	265	29	29	20.64	5	1956
3	67	9,508	248	335	1,363	46,870	203	50	50	12.45	11	1911-58
4	457	31,578	1,189	2,828	8,967	152,230	207	180	405	26.39	30	1913-58
5	75	2,546	109	368	732	16,325	156	60	60	29.29	10	1927-52
6	70	20,816	700	927	3,633	70,000	297	35	35	23.25	5	1954-57
7	374	24,134	2,318	3,070	7,296	109,210	221	122	252	49.34	31	1902-47
8	104	7,591	158	697	1,624	35,570	213	117	117	24.06	22	1920-58
9	32	3,433	175	370	652	15,700	219	13	13	34.75	1	1946-55
10	375	34,167	1,546	2,687	8,241	151,330	226	97	97	27.98	15	1949-58
11	10	1,694	22	114	111	5,280	321	4	4	25.97	1	1943-56
12	466	43,090	1,875	4,041	14,578	202,500	212	129	129	29.21	13	1948-58
13	1,059	99,632	3,474	6,631	23,164	421,160	237	280	280	23.99	24	1931-58
14	110	27,855	231	922	1,427	89,900	310	55	143	12.83	16	1956-58
15	738	61,439	3,247	6,031	3,360	316,660	194	228	630	29.30	23	1932-58
16	182	20,367	403	1,061	3,360	70,410	289	51	51	20.80	7	1953-57
17	495	42,322	1,798	3,254	9,688	183,394	231	173	486	27.55	28	1940-58
18	1,136	163,500	5,283	10,156	39,708	582,270	281	453	453	26.51	37	1945-58
19	326	68,069	2,409	2,636	12,107	272,100	250	180	180	18.54	24	1948-58
20	443	47,232	1,835	3,195	10,550	198,980	237	155	155	25.28	22	1929-56
21	276	47,468	908	2,208	7,528	130,000	365	65	65	23.97	11	1951-53
22	484	71,221	2,473	4,183	19,862	308,460	231	141	141	21.58	23	1950-58
23	219	20,857	690	1,496	4,601	76,000	274	34	34	28.77	10	1951-56
24	316	15,994	1,210	2,346	3,904	78,315	204	97	173	45.41	20	1909-58
25	248	37,227	567	1,942	5,161	140,790	264	191	191	17.82	30	1925-57

CENTRIFUGAL STATIONS

Company	No. employes	Plant cost (thou. $)	Expenses (thou. $) Fuel or power	Other	Compr. fuel (M.M.c.f.)	Total hp.	Investment per hp. ($)	No. driving units	No. compr. units	Expenses per hp. ($)	No. stations	Year installed
GAS ENGINE												
1	50	24,938	607	1,069	3,149	70,000	356	20	20	23.95	5	1957
GAS TURBINE												
1	97	41,221	1,352	1,553	11,102	179,600	230	32	32	16.18	12	1952-58
2	38	12,003	523	268	3,488	56,400	213	8	8	14.03	2	1953
3	48	5,697	226	308	1,507	18,900	301	3	3	28.30	3	1956
4	50	13,869	304	389	2,279	38,500	360	6	6	18.02	4	1955-58
5	174	49,811	1,398	1,011	7,430	250,400	199	34	34	12.19	13	1956-58
ELECTRIC MOTOR												
1	11	2,246	189	72	——	12,500	179	1	1	20.93	1	1958
2	6	1,905	43	37	——	4,500	423	3	3	18.07	1	1958
3	203	30,077	7,848	1,373	——	210,500	143	68	68	43.80	22	1948-58
STEAM TURBINE												
1	75	10,601	671	459	5,391	53,200	199	11	11	21.23	3	1951-52

Data from 1958 annual reports filed with FPC.

expenses—the cost of purchased gas. The chart reflects the fact that gas pipelines have not been able to recover through increased rates the full amount of purchased-gas costs.

Expenses increased 530% from 1949 to 1958, revenues increased 450%, and net income increased only 250% on gas-transmission lines. Operating expenses were 57% of revenues in 1949 compared with 65% in 1958. Income has declined from 16.5% of revenues to 10.4% in the same period.

By way of contrast, oil pipelines have no burden similar to purchased gas on gas lines; and so they have been able to take greater advantage of the lower costs of larger diameters. The world crude-oil surplus temporarily upset the trend of steadily decreasing unit costs, but it is expected to be resumed. During the 10-year period, oil-pipeline operating expenses have declined from 66% of revenues to 54%. Net income has increased from 15% to 22% of revenues.

Centrifugal stations lower costs for fiscal 1960

Average industry investment costs reported in the year ending this month are lower than 1959 due to abnormal number of centrifugal installations.

How construction costs are affected by location, type of drive, and whether the unit is a new station or an addition is shown in the table on the next two pages. Individual centrifugal units are keyed in the table and summarized at the end.

TOTAL centrifugal horsepower for which installed costs were reported to FPC during fiscal 1960 actually exceeded reciprocating horsepower by a wide margin. And the average costs per horsepower for the year are correspondingly lower than normal.

(Costs represent installations reported during the fiscal year under requirements for such statements within 6 months after a project has been completed. Hence actual costs are for prior years shown in "year built" column.)

Centrifugal vs. Reciprocating Costs

The average for all units was only $219 per horsepower in fiscal 1960 compared with $304 for all units reported in the previous year. The reason is the preponderance of centrifugal installations reported in 1960, because of the heavy programs by two companies—Texas Eastern Transmission Corp. and Columbia Gulf Transmission Co. Centrifugal installations totaled 386,300 hp., averaging $199 per horsepower, compared with 199,745 hp. and an average of $257 for reciprocating units. Reciprocating costs were lower than normal because most of the horsepower was in station additions, which may cost from $50 to $100 per horsepower less than new stations.

In fiscal 1959, only 20,000 hp. in centrifugal units was reported.

In fiscal 1960, the average for 102,500 hp. using electric drive was $125. The extremely low unit costs of large (15,000-hp.) single-unit installations were responsible for this abnormal figure. The average for 234,800 hp. using gas-turbine drive was $219. The average for 49,000 hp. using gas-engine centrifugals was $298.

The usual wide range of costs was found—from $497 to $147 per horsepower for reciprocating station additions.

Costs for Current Projects

Most current expansion is in existing stations, and installations are predominantly reciprocating. Detailed breakdowns of estimates for both new stations and additions are offered to show methods of estimating and costs for various types of drive and various locations. (See below and page 104.)

The experimental gas-turbine station shown is based on use of an aircraft-type jet engine connected to a power turbine driving a centrifugal compressor. Its cost of $148 per horsepower is low, for both the material and labor components, lower even than the electric station shown.

The 7,500 hp. electric - centrifugal station has a material cost identical to the experimental gas turbine, but installation is higher, accounting for the difference between $148 and $193, the unit electric cost.

The engine - compressor station shown might be considered typical of this type. Higher material costs account for the higher total cost of $327 in comparison with the centrifugal stations.

Current projects for station additions, all reciprocating units, as represented in exhibits filed with FPC applications, show an average cost of $288 per horsepower. Average material cost is $198 and average installation cost is $79. (The two components do not add up to the $288 total because certain costs are not allocated in some estimates.) Costs of these additions range from $169 per horsepower for a 4,400-hp. expansion in Virginia to $432 for a 6,800-hp. expansion in Texas, which had unusual auxiliary-equipment outlays.

The $288 average for current projects compares with $271 for additions reported in fiscal 1959, $235 in fiscal 1958, and $199 for additions reported in fiscal 1957. These average figures do not necessarily show trends; they merely represent costs for stations installed during a particular period. A year during which several stations were installed in South Louisiana, for example, where costs are generally quite high, will have an abnormally high average, independent of the trend of labor and materials prices.

Estimated Costs for Current Compressor-Station Additions

(Dollars per hp.)

Location	Horsepower	Material	Installation	Total
Georgia	2,500	$183	$97	$380
Kentucky	2,000	203	84	301
Louisiana	2,200	196	107	320
Maryland	2,000	186	94	280
North Carolina	3,820	130	68	198
North Carolina	2,000	186	94	280
Pennsylvania	3,820	131	71	202
Pennsylvania	2,000	206	102	308
South Carolina	2,500	166	94	260
Tennessee	2,500	189	68	269
Texas	2,500	172	92	264
Texas	6,800	378	44	432
Virginia	2,000	191	109	300
Virginia	2,500	173	97	280
Virginia	4,400	129	40	169
Virginia	2,000	191	109	300
Average	2,846	$198	$79	$288

Compressor-Station Construction Costs

(Reported to FPC in Fiscal 1960)

Cap. (hp.)	Land & impr.	Struc. & equip.	Misc. & const.	Total	Per hp.	Year built	New station or addition
ALABAMA							
† 7,500	———	$ 707,574	$233,047	$ 940,621	$125	1956-58	Addition
350	$ 300	95,846	9,804	105,450	303	1958	Addition
IOWA							
2,000	2,126	486,953	51,272	540,357	270	1959	Addition
KANSAS							
1,800	1,588	352,557	30,867	385,012	214	1959	New
2,000	2,330	429,723	39,579	471,632	236	1959	Addition
2,000	1,018	452,124	41,190	494,332	247	1959	Addition
1,350	———	301,339	7,752	309,091	229	1956	Addition
2,700	———	388,470	8,882	397,352	147	1956	Addition
7,000	———	1,544,595	45,051	1,589,646	227	1958	Addition
2,000	3,329	439,498	45,792	488,619	244	1959	Addition
KENTUCKY							
†15,000	———	1,057,277	662,916	1,720,193	115	1956-58	New
*15,200	———	2,430,817	623,047	3,053,864	201	1956-58	New
*15,200	———	3,119,158	113,835	3,232,993	213	1959	Addition
3,520	———	574,722	148,627	723,349	245	1956-58	Addition
5,280	———	881,208	172,992	1,254,200	200	1956-58	Addition
‡ 7,000	51,800	2,204,447	123,676	2,379,893	340	1957	Addition
4,000	25,500	1,034,633	58,138	1,118,271	280	1957	Addition
LOUISIANA							
*10,000	———	1,805,318	437,912	2,243,230	224	1956-58	New
*10,000	———	2,155,395	464,573	2,619,908	262	1956-58	New
*10,000	———	1,583,791	339,900	1,923,691	192	1956-58	New
4,000	22,910	1,045,212	58,138	1,126,260	282	1957	Addition
‡10,500	55,480	2,843,143	156,559	3,057,162	291	1957	Addition
4,000	24,480	1,100,108	61,310	1,185,898	296	1957	Addition
*15,200	———	3,159,134	82,347	3,241,481	213	1959	Addition
1,650	———	549,338	44,408	593,746	360	1959	Addition
5,200	———	1,132,094	256,922	1,389,016	267	1958	Addition
5,280	———	982,995	196,964	1,179,959	223	1958	Addition
5,200	———	970,646	200,963	1,171,609	225	1958	Addition
MISSISSIPPI							
†15,000	———	1,079,533	798,596	1,858,129	124	1956-58	New
10,000	———	2,203,145	478,504	2,681,649	268	1956-58	New
*10,000	———	1,476,162	359,016	1,835,178	184	1956-58	New
4,000	23,460	1,063,908	59,195	1,146,563	287	1957	Addition
‡10,500	55,584	2,878,390	160,673	3,094,647	295	1957	Addition
13,600	———	3,585,643	121,726	3,707,369	273	1959	Addition
*15,200	———	3,176,169	79,396	3,255,565	214	1959	Addition
10,000	———	2,151,564	85,622	2,207,186	224	1959	Addition
†15,000	———	1,704,750	58,983	1,763,733	118	1959	Addition
5,280	———	996,673	207,202	1,203,875	228	1958	Addition
5,200	———	950,622	212,270	1,162,892	224	1958	Addition
5,000	———	966,374	218,234	1,184,608	237	1958	Addition
5,000	———	842,526	212,411	1,054,937	211	1956-58	Addition
2,500	———	543,584	139,845	683,429	273	1956-58	Addition
*10,500	56,163	2,825,119	157,502	3,038,784	289	1957	Addition
MONTANA							
880	———	424,269	12,774	437,043	497	1957	Addition
NEBRASKA							
4,000	4,301	901,527	104,334	1,010,162	253	1959	Addition
2,000	2,605	492,444	21,212	516,261	258	1959	Addition
NEW JERSEY							
2,850	555	544,530	145,968	691,053	242	1958	Addition

Compressor-Station Construction Costs (Cont'd.)

(Reported to FPC in Fiscal 1960)

Cap. (hp.)	Land & impr.	Struc. & equip.	Misc. & const.	Total	Per hp.	Year built	New station or addition
NEW MEXICO							
125	———	$ 34,377	$ 7,702	$ 42,079	$337	1959	Addition
2,200	$ 2,420	906,130	52,627	961,177	437	1957	Addition
NEW YORK							
1,000	———	183,600	13,600	197,200	197	1959	Addition
OHIO							
*15,200	———	2,423,481	712,726	3,136,207	206	1956-58	New
*15,200	———	3,239,835	127,608	3,365,443	221	1957	Addition
† 7,500	———	777,314	246,955	1,024,269	137	1956-58	Addition
† 5,000	———	857,328	279,602	1,136,930	227	1956-58	Addition
OKLAHOMA							
1,350	1,765	254,880	6,724	263,369	195	1956	Addition
2,000	1,145	452,144	12,064	465,353	232	1959	Addition
PENNSYLVANIA							
*10,000	———	2,051,222	409,334	2,460,556	246	1958	New
*10,000	477	2,074,063	400,958	2,475,502	248	1958	New
8,800	———	1,867,194	450,345	2,317,539	263	1956-58	New
*13,400	39,219	2,943,612	192,293	2,675,124	200	1959	New
*13,400	24,370	2,513,506	154,226	2,692,102	201	1959	New
*13,400	79,169	2,368,179	120,157	2,567,505	192	1959	New
*13,400	36,276	2,464,716	141,248	2,642,240	197	1959	New
10,000	———	2,512,945	140,771	2,653,716	265	1959	Addition
880	———	192,405	51,724	244,129	277	1959	Addition
3,300	———	725,614	194,422	920,036	279	1958	Addition
* 5,000	———	884,845	195,319	1,080,164	216	1958	Addition
* 5,000	———	911,254	192,019	1,103,273	221	1958	Addition
4,000	———	890,243	153,346	1,043,589	261	1958	Addition
* 5,000	———	725,689	144,899	870,588	174	1958	Addition
* 5,000	———	774,360	141,750	916,110	183	1958	Addition
* 5,000	———	739,149	142,451	881,600	176	1958	Addition
* 5,000	———	786,177	144,711	930,888	186	1958	Addition
7,500	———	1,180,827	296,186	1,477,013	197	1956-58	Addition
TENNESSEE							
†15,000	———	1,164,312	773,537	1,937,849	129	1956-58	New
†15,000	———	1,564,336	48,862	1,613,198	108	1959	Addition
† 7,500	———	736,358	224,521	960,879	128	1956-58	Addition
‡10,500	57,900	2,837,533	158,559	3,053,992	291	1957	Addition
4,000	53,354	1,039,700	58,200	1,151,254	288	1957	Addition
TEXAS							
10,250	———	2,182,514	424,878	2,607,392	254	1958	New
2,200	17,660	900,223	236,291	954,174	434	1956-58	New
5,000	63,582	1,151,220	299,748	1,514,550	303	1956-58	New
2,000	3,155	595,019	30,472	628,646	314	1959	Addition
5,500	———	1,296,702	338,801	1,635,503	297	1956-58	Addition
102,500	total electric motor			$ 12,955,801	$125		
234,800	total gas turbine			49,203,212	219		
49,000	total engine centrifugal			14,624,478	298		
386,300	total centrifugal			76,783,491	199		
199,745	total reciprocating			51,287,545	257		
586,045	grand total			128,071,036	219		

*Gas turbine centrifugal.
†Electric motor centrifugal.
‡Engine-driven centrifugal.

10,500-HP Experimental Gas Turbine-Centrifugal Unit
(at existing Clementsville, Ky., station)

Item	Material	Installation	Total
MAIN COMPRESSOR BUILDING AND CONTROL ROOM			
Foundation and floor	$ 2,500	$ 6,000	$ 8,500
Superstructure	34,000	24,000	58,000
Compressor units (jet engine, centrifugal compressor, oil filter, seal oil tank, oil coolers)	775,000	20,000	795,000
Air intake filter-silencer	15,000	4,000	19,000
Auxiliary equipment	6,600	2,000	8,600
Gage and panels	4,200	300	4,500
Power wiring and controls	25,000	28,000	53,000
Automatic fire protection	3,000	2,000	5,000
Miscellaneous piping	20,000	18,000	38,000
Gas-snifter system	5,000	1,400	6,400
Subtotal	$890,300	$105,700	$996,000
YARD			
Air receiver tanks	1,000	500	1,500
Sewers and drains	2,200	8,200	10,400
Roads, walks, curbs	4,000	2,000	6,000
Grading	100	2,000	2,100
Water-cooling equipment	5,000	1,000	6,000
Power wiring and electrical controls	20,000	22,000	42,000
Suction and discharge piping	135,500	68,400	203,900
Miscellaneous piping	20,000	22,000	42,000
Fire-hose shed	300	800	1,100
Subtotal	$188,100	$126,900	$315,000
CONTROLS			
Controls for station	60,000	1,000	61,000
Controls for controlling station	11,000	1,000	12,000
Subtotal	$71,000	$2,000	$73,000
CONTINGENCIES			
Engineering, supervision, administrative, legal, and services	.....	96,000	96,000
Total	$1,206,900	$357,100	$1,554,000
Per horsepower	$115	$32	$147

7,500-HP Electric-Motor Driven Unit
(In Idaho)

Item	Material	Installation	Total
Site improvements	$ 20,000	$ 56,000	$ 76,000
Buildings	55,000	74,000	129,000
Compressor units	300,000	56,000	356,000
Major gas piping	195,000	176,000	371,000
Electrical system	233,000	180,000	413,000
Lube-oil system	22,000	9,000	31,000
Utility systems	16,000	33,000	49,000
Equipment, tools and supplies	25,000	.....	25,000
Total direct costs	$866,000	$584,000	$1,450,000
Per horsepower	$115	$78	$193

Current estimates for compressor stations using

- Gas turbine
- Engine compressor
- Electric motor

8,000-HP Gas-Engine Compressor Station
(In Illinois)

Item	Total
LAND	$20,300
MATERIAL AND INSTALLATION	
Four 2,000-hp. vertical gas engines	988,400
Engine accessories	44,000
50-kw. generator, accessories	5,500
Switchboard and motor-control center	4,900
Air compressor	6,800
Gas scrubber	14,000
Scrubber-oil storage tank	7,600
Lube-oil storage tank	2,300
Air storage tanks (2)	3,600
Water storage tank	7,200
Water supply	16,000
Water coolers (atmospheric, jacket water—4)	56,800
Compressor building bays for vertical engines (5)	50,000
Office and utility building	14,000
Foundations	44,000
Residences and 1-car garage (3)	75,000
Plant electrical materials	25,000
Radio building, tower	13,000
High-pressure gas valves and valve operators	40,000
Plant piping, miscellaneous valves, fittings, controls	165,000
Miscellaneous materials, lumber, paint, etc.	90,000
Equipment garage and pipe racks	13,000
Roads, landscaping, sidewalks, purge gas, etc.	22,000
Total material	$1,708,100
Per horsepower	$213
Total installation	$525,000
Per horsepower	$68
Field engineering and inspection	35,000
TOTAL DIRECT COSTS	$2,288,400
General overhead (7% of direct costs—2.7% administrative and general, 2.3% engineering and supervision, 2% interest during construction)	160,200
Contingencies	163,400
TOTAL	$2,612,000
PER HORSEPOWER	$327

PIPELINES

What it costs to build a pipeline

It takes more money each year to install the same amount of pipeline. This is no news to any pipeliner who has to estimate, build, or pay for a line. For almost every component that goes into the total cost has increased steadily in recent years.

This is part of the story that is told in the tables, computed from figures filed with the Federal Power Commission, on the next eight pages.

THE TABLE starting on this page represents costs reported to FPC during the 1960 fiscal year ending June 30; reports are for projects completed primarily in 1959, although some date back to 1958. FPC regulations require such cost statements within 6 months after a project has been completed.

The reports are tabulated by laterals and main transmission lines to provide FPC's own check on construction costs. Costs reported in fiscal 1960 are carried in detail, project by project, on the next three pages. This table is followed by one summarizing costs reported in the 1954, 1959, and 1960 fiscal years.

Inflation Rules

As these tables show, right-of-way comes dearer and tougher each year. There are some instances where the ground in which the pipe is buried costs more than the pipe laying itself.

Materials inflation—particularly pipe—is so regular that it is a routine part of estimating. Materials costs are higher, not only because of inflation, but also because more and more lines are being laid in difficult terrain where materials requirements are greater (weight coating in marsh country or offshore may cost almost as much as the pipe).

The entry of pipelines into new produc-

Gas-Pipeline Construction Costs

(Figures reported to FPC in fiscal 1960)

Transmission Laterals

Diam.		Miles	Right-of-way	Materials	Labor	Misc.	Total
2 in.		14.6	$ 1,562	$ 44,477	$ 44,024	$ 2,739	$ 92,082
	$/Mile		107	3,047	3,015	187	6,356
3 in.		10.3	23,430	61,946	41,014	10,312	136,702
		14.8	33,649	87,843	86,370	14,396	222,258
		8.8	43,131	52,835	39,673	8,021	143,660
	Total	33.9	100,210	202,624	167,057	32,729	502,620
	$/Mile		2,956	5,977	4,928	966	14,827
4 in.		6.00	1,173	44,967	40,575	6,807	93,522
		7.58	5,814	44,437	78,071	4,607	132,929
		9.70	2,986	39,845	56,637	5,592	105,060
		17.30	11,129	91,524	234,846	18,913	356,412
		5.02	15,969	37,422	23,761	13,364	90,516
		5.56	88	42,328	28,220	14,107	84,743
		5.60	25,642	52,389	169,972	3,826	251,829
	Total	56.76	62,801	352,912	632,012	67,216	1,115,011
	$/Mile		1,107	6,218	11,136	1,184	19,645
6 in.		4.8	11,844	41,680	34,722	5,646	93,892
		5.7	10,533	61,090	28,579	7,291	107,493
		6.0	8,216	48,846	66,724	7,450	131,236
		10.6	40,073	124,029	131,240	18,073	313,415
		7.6	20,458	64,336	43,445	7,550	135,789
		30.4	44,063	305,206	170,094	23,519	542,882
		5.1	12,240	45,359	29,309	8,691	95,599
		13.0	32,246	111,678	102,569	31,261	277,754
		15.5	8,482	195,205	64,302	15,619	283,608
		6.4	38,407	67,085	123,305	6,762	235,559
	Total	105.1	226,562	1,064,514	794,289	131,862	2,217,227
	$/Mile		2,156	10,128	7,557	1,255	21,096
8 in.		18.1	76,494	247,182	228,632	33,289	585,597
		9.0	20,946	119,815	74,492	12,615	227,868
		5.12	7,598	72,255	19,530	5,489	104,872
		5.4	1,484	69,492	13,787	342	85,105
		7.7	9,243	119,191	60,176	8,573	197,183
		13.2	34,579	165,347	135,797	23,129	358,852
		10.63	59,956	142,625	687,033	30,570	920,184
	Total	69.15	210,300	935,907	1,219,447	114,007	2,479,661
	$/Mile		3,041	13,534	17,635	1,649	35,859

ing regions, especially offshore Louisiana, and increased construction through congested areas also are responsible for higher installation costs.

Labor frequently costs more than all materials. This may be true even for the largest diameters, although the materials-labor ratio increases steadily with the diameter in normal circumstances.

Contract Prices Stabilize

But labor actually appears to have become the most stable cost factor in installing pipelines. Current estimates indicate that the contract price figured for a 1960 project is no higher than last year, or 5 years ago in some cases. A check with several companies confirms this fact.

In some instances, due to increased competition, contract prices in the same area may be down. There are a lot of contractors after the same dollar; a company that can pick its own construction period can take advantage of competition and get the job done for what is, from its own viewpoint, a good price.

However, this is usually impossible for a gas pipeline which, more often than not, is caught between a late summer FPC go-ahead and a fall completion deadline. Oil pipelines are in a better position to schedule projects.

Interpreting Costs

The figures in the adjoining table represent all projects for which cost statements were filed with FPC during the fiscal year ending this month.

They show principally the cost experience of companies which have completed pipelines within the past 18 months. The range of costs per mile for the same diameter frequent-

Gas-Pipeline Construction Costs (continued)

Transmission Laterals

Diam.		Miles	Right-of-way	Materials	Labor	Misc.	Total
10 in.		5.7	16,615	75,654	76,032	7,468	175,787
		6.5	29,581	115,316	386,748	23,598	555,243
		17.0	89,859	321,885	666,070	47,932	1,125,746
	Total	29.2	136,055	512,855	1,128,850	79,016	1,856,776
	$/Mile		4,659	17,564	38,659	2,706	63,588
12 in.		6.0	27,316	168,298	345,745	20,550	561,909
		10.1	94,219	267,057	732,471	35,676	1,129,423
		27.8	37,309	800,440	375,585	52,589	1,265,923
		28.0	134,186	631,087	540,221	80,853	1,386,347
		10.2	34,925	241,274	116,574	23,500	416,273
		21.5	72,606	523,986	1,120,476	30,880	1,747,948
	Total	103.6	400,561	2,632,142	3,231,072	244,048	6,507,823
	$/Mile		3,866	25,407	31,188	2,355	62,816
14 in.		22.0	113,137	563,792	694,201	20,069	1,391,199
	$/Mile		5,142	25,627	31,555	912	63,236
16 in.		11.28	49,055	986,389	112,573	15,965	1,163,982
		28.37	40,570	484,937	275,211	13,918	814,636
		5.23	8,480	206,494	113,203	18,453	346,630
		34.7	201,004	1,038,607	1,526,147	98,542	2,864,300
		13.2	22,181	396,996	504,886	42,475	966,538
		11.5	14,064	460,186	704,693	12,517	1,191,460
	Total	104.28	335,354	3,573,609	3,236,713	201,870	7,347,546
	$/Mile		3,215	34,269	31,039	1,936	70,459
20 in.		43.56	338,887	2,494,194	3,114,247	122,949	6,070,277
	$/Mile		7,780	57,259	71,493	2,822	139,354

Main Transmission Lines

Diam.		Miles	Right-of-way	Materials	Labor	Misc.	Total
6 in.		20.5	7,392	178,055	111,913	14,396	311,729
	$/Mile		361	8,685	5,459	701	15,206
8 in.		7.5	6,835	113,825	64,820	7,955	193,435
	$/Mile		910	15,177	8,643	1,061	25,791
10 in.		27.8	24,969	512,292	133,763	13,192	684,216
		5.6	4,700	106,500	45,483	14,101	170,784
	Total	33.4	29,669	618,792	179,246	27,293	855,000
	$/Mile		888	18,527	5,366	817	25,598
12 in.		11.9	13,702	301,656	94,348	20,790	430,496
		7.64	23,066	157,127	263,192	17,143	460,528
		15.5	6,792	311,562	52,232	22,172	392,758
	Total	35.04	43,560	770,345	409,772	60,105	1,283,782
	$/Mile		1,243	21,985	11,694	1,715	36,637
16 in.		15.2	22,255	501,920	196,530	25,165	745,870
		12.5	45,858	342,440	193,558	13,801	595,657
		64.8	86,980	1,736,162	642,154	84,408	2,549,704
		13.25	34,219	473,794	266,628	45,649	820,290
	Total	105.75	189,312	3,054,316	1,298,870	169,023	4,711,521
	$/Mile		1,790	28,882	12,283	1,598	44,553

ly varies several hundred per cent, mainly because of terrain and weather.

The average costs are not necessarily what you would expect for "average" conditions. This figure is influenced by the location of projects built during this period. The shift of activity from one region to another can produce average figures which run counter to the trend of actual costs. (See table on next page.) They are significant only when read with this limitation in mind, and can be very misleading to the uninitiated who might try to use them for appraisals or estimates.

Big-Inch Trend

Projects listed in the adjoining table show the domination of 30-in. in transmission lines. Of the $313 million in pipeline construction represented by both laterals and main lines, 73% is for 30-in. lines; 75% of the mileage reported here for transmission lines is 30-in.

Next year's figures, according to pending projects, will continue to show a high volume of 30-in., and an increasing proportion of 36-in.

Right-of-Way Trend

The right-of-way cost trend is one of the more interesting aspects of the table on the next page summarizing costs reported in 1954, 1959, and 1960. Costs in the smaller diameters have risen from hundreds of dollars to thousands of dollars per mile in this short period. The highest listed for any diameter is $11,508 per mile for a 36-in. line this year. The averages are roughly from $1,000 to $4,500 per mile.

Gas-Pipeline Construction Costs (continued)

(Figures reported to FPC in fiscal 1960)

Main Transmission Lines

Diam.		Miles	Right-of-way	Materials	Labor	Misc.	Total
20 in.		29.47	75,900	703,700	739,100	46,500	1,565,200
		29.0	114,811	1,068,183	979,822	80,995	2,243,810
		16.4	25,140	520,451	642,102	35,787	1,223,480
		16.92	55,772	591,724	354,967	28,386	1,030,849
		9.9	34,870	414,300	168,492	21,300	638,963
		24.4	9,860	835,552	372,104	32,182	1,249,698
		5.0	20,069	143,863	118,505	10,231	292,668
		19.9	57,462	657,110	689,175	110,629	1,514,376
	Total	141.82	393,884	4,934,883	4,064,268	366,010	9,759,044
	$/Mile		2,777	34,797	28,658	2,581	68,813
24 in.		54.0	203,580	3,295,380	901,740	179,806	4,580,506
		45.0	140,508	2,134,037	654,335	79,515	3,008.395
		6.4	16,000	264,200	161,800	16,000	458,000
		9.2	32,559	355,921	234,058	21,757	644,295
		11.48	42,071	770,389	1,024,889	26,723	1,864,072
		6.0	5,869	441,463	529,331	19,560	996,223
		9.35	8,063	730,438	564,770	33,311	1,336,582
		42.52	90,642	2,415,288	838,231	73,750	3,417,911
	$/Mile	183.95	593,292	10,407,116	4,909 154	450,422	16,305,984
	Total		2,932	56,575	26,687	2,448	88,642
26 in.		5.6	21,107	238,124	156,180	19,749	435,162
		12.0	25,296	682,342	508,664	55,594	1,271,896
		11.8	7,989	620,922	393,437	58,269	1,080,617
		14.46	12,200	780,300	332,200	34,100	1,158,800
		18.5	43,207	1,007,638	869,758	153,330	2,073,933
		67.43	193,047	4,532,890	1,229,789	148,810	6,104,536
	Total	129.79	302,848	7,862,216	3,490,028	469,852	12,124,944
	$/Mile		2,333	60,576	26,890	3,620	93,419
30 in.		351.7	1,586,442	26,801,900	11,745,500	1,668,314	41,802,156
		96.5	248,575	6,708,345	4,195,020	521,074	11,673,014
		377.0	1,504,465	22,836,652	14,106,769	1,877,824	40,325,710
		422.0	2,113,932	29,372,161	12,749,010	2,523,193	46,758,296
		530.0	2,248,815	34,434,058	20,285,967	2,873,445	59,842,285
		18.2	27,000	1,126,143	239,223	59,538	1,451,904
		9.3	16,951	568,814	119,937	38,187	733,889
		6.37	6,505	388,891	126,401	5,538	527,335
		8.0	16,122	514,004	143,395	54,294	727,815
		11.0	23,533	734,364	198,018	67,196	1,023,111
		59.0	159,019	4,565,836	2,749,611	19,788	7,494,249
		28.8	37,877	1,954,149	2,249,064	7,697	4,248,787
		12.5	95,819	861,737	1,095,186	33,743	2,086,485
		18.1	58,671	1,214,065	412,904	107,501	1,793,141
		8.8	34,161	548,365	175,792	46,318	804,636
		10.7	14,745	687,034	192,943	21,070	915,792
		8.0	12,988	504,021	157,396	51,408	725,813
		17.3	31,430	1,069,874	340,571	106,018	1,547,893
		12.3	39,047	817,455	269,167	28,489	1,154,158
		4.5	13,114	289,585	85,217	15,878	403,794
		9.0	16,424	581,709	160,912	31,752	790,797
		9.7	13,421	623,603	171,669	43,044	851,737
	Total	2,028.5	8,319,056	133,202,756	71,969,672	10,191,304	227,682,797
	$/Mile		4,101	67,637	35,479	5,024	112,242
36 in.		50.1	576,550	4,136,275	4,818,618	456,694	9,988,137
	$/Mile		11,508	82,560	96,180	9,116	199,364

The Trend of Pipeline-Construction Costs

($/mile reported to FPC in fiscal 1954-59-60)

Diameter	Minimum	Maximum	Total	Average R/W	Material	Labor	Misc.	Year
2 in.	$4,976	$11,754	$6,088	$484	$2,544	$2,704	$356	1954
	.....	.....	.....	.....	.....	.....	.....	1959
	.....	.....	6,356	107	3,047	3,015	187	1960
3 in.	4,992	6,624	5,232	510	2,523	2,169	30	1954
	13,935	17,718	14,955	2,412	5,106	6,396	1,041	1959
	13,272	16,325	14,827	2,956	5,977	4,928	966	1960
4 in.	7,624	8,208	11,304	500	5,312	4,196	1,296	1954
	8,404	22,772	10,092	476	5,316	4,180	120	1959
	10,830	44,969	19,645	1,107	6,218	11,136	1,184	1960
6 in.	12,312	19,686	17,232	660	9,468	6,408	696	1954
	15,750	52,962	24,414	1,422	8,634	12,720	1,638	1959
	17,858	36,806	21,096	2,156	10,128	7,557	1,255	1960
8 in.	11,880	36,464	20,256	784	9,472	8,736	1,264	1954
	13,088	45,872	28,952	1,224	13,464	12,712	1,552	1959
	15,760	86,564	35,859	3,041	13,534	17,635	1,649	1960
10 in.	15,310	23,440	20,040	810	12,760	5,720	750	1954
	25,580	55,620	40,380	1,580	17,460	19,710	1,630	1959
	30,840	85,114	63,588	4,659	17,564	38,659	2,706	1960
12 in.	40,404	145,596	40,404	1,272	20,832	17,400	900	1954
	38,904	72,360	50,280	2,244	21,276	23,880	2,880	1959
	25,339	60,278	36,637	1,243	21,985	11,694	1,715	1960
16 in.	27,824	269,120	30,800	1,408	18,688	9,904	800	1954
	40,576	74,720	55,888	1,296	33,184	19,456	1,952	1959
	39,347	61,908	44,553	1,790	28,882	12,283	1,598	1960
20 in.	44,060	49,720	46,200	1,580	28,040	15,080	1,500	1954
	42,220	63,060	54,300	1,400	33,600	16,360	2,940	1959
	51,217	77,373	68,813	2,777	34,797	28,658	2,581	1960
24 in.	63,120	64,176	64,128	2,664	36,672	21,408	3,384	1954
	60,432	72,792	65,688	2,040	42,120	18,744	2,784	1955
	66,853	166,037	88,642	2,932	56,575	26,687	2,448	1960
26 in.	.....	.....	73,424	3,068	37,232	31,330	1,794	1954
	60,970	113,412	68,510	2,314	43,524	18,174	173	1959
	77,707	112,104	93,419	2,333	60,576	26,890	3,620	1960
30 in.	70,200	83,610	77,970	1,530	57,570	15,150	3,720	1954
	78,270	137,670	86,760	2,220	55,410	24,780	4,498	1959
	78,913	166,919	112,242	4,101	67,637	35,479	5,024	1960
36 in.	.....	.....	.....	.....	.....	.....	.....	1954
	131,904	135,324	133,056	3,456	89,100	21,888	5,868	1959
	.....	.....	199,364	11,508	82,560	96,180	9,116	1960

What you can expect in

1960-61 pipeline construction costs

▶ Examples selected show a wide range of diameters and varied terrain to represent as many construction situations as possible. Projects have been recently approved or are still pending before FPC, and are planned for the next two construction seasons.

THE SCIENCE of pipeline-cost estimating is not as exact as pipeline engineers (and contractors) would like it to be because of certain variables which defy prediction.

But the industry by now has a rich fund of experience to draw upon, even in some of the relatively new areas, so that guessing can be reduced to a minimum. Estimates for current projects are detailed on the next five pages, reflecting costs for both new and old areas. They were obtained from exhibits filed with certificate applications pending before FPC.

The various estimates show the variety of approaches by different companies. They should not be considered as actual costs, but only as what they are: anticipated costs of specific projects in specific locations.

10 and 12-in. Marsh Construction

Several South Louisiana and offshore projects are presented because of the activity there and because of the hazards in estimating. The first table shows an estimate of $70,204 per mile for a completed 10-in. line to Caillou Island. This compares with $54,771 for the marsh section and $45,081 for the dry-land section of the 10-in. Bayou Chevreuil line.

All of these are well above the minimum of $24,612 reported for this diameter in fiscal 1960. Installation costs alone exceed the entire cost of some dry-land projects of the same diameter.

The same pattern is seen in the 12-in. lines to West Delta Block 30, East Cameron, and Grand Isle, La., the latter including some 16-in. pipe. Even these costs of $88,879, $89,516, and $108,920 per mile are not as high as a 10-mile 12-in. project completed during the past year at $111,824 per mile. This compares with $40,811 per mile for a 12-in. line built in good laying country last year.

16-in. Construction

The tremendous difference in laying conditions and resulting costs is

Estimated Cost of Current Pipeline Projects

9.8-Mile 10-in. Line to Caillou Island, La.

Item	Material	Installation	Total
Right-of-way, damages	$	$ 37,632	$ 37,632
Preliminary survey	.....	9,800	9,800
Main-line pipe	170,100	191,290	361,390
Coating material, incl. concrete	85,305	.....	85,305
Valves, drips, etc.	6,000	.....	6,000
Plugs	.....	4,000	4,000
Hot tap	.....	30,000	30,000
Platform	.....	9,000	9,000
Foreign lines	.....	30,000	30,000
Miscellaneous material (2% of detailed cost)	5,228	.....	5,228
Field engineering and inspection	.....	.....	24,500
General overhead (7.7% of direct cost)	.....	.....	46,420
Contingencies	.....	.....	37,725
Total	**$ 266,633**	**$ 311,722**	**$ 688,000**
Per Mile	**$ 27,207**	**$ 31,808**	**$ 70,204**

504.1-Mile 24-in. Line from Emerson, Man., to Marshfield, Wis.

Item	Material	Installation	Total
Right-of-way, damages (8.50/rod)	$	$ 1,371,152	$ 1,371,152
Preliminary survey (700/mile)	.....	352,870	352,870
Line pipe			
24-in. x .281-in. (2,541,448 ft. at 7.65/ft. material, 4.75/ft. installation)	19,442,077	12,071,878	31,513,955
24-in. x .500-in. (115,000 ft. at 12.50/ft. material, 4.75/ft. installation)	1,437,550	546,250	1,983,750
Coating material (.45/ft.)	1,195,402	.....	1,195,402
Main-line valve assemblies (34)	408,000	68,000	476,000
Drips (4)	4,800	6,000	10,800
Highway and railroad crossings			
30-in. x .375-in. pipe (30,000 ft.)	364,500	900,000	1,264,500
Casing bushings (1,200)	36,000	.....	36,000

nowhere better demonstrated than by the two 16-in. projects shown. Right-of-way for the 7.03-mile line in New Jersey, one of the most expensive construction areas in the country, cost more than pipe and all other materials. Installation costs of $79,500 per mile for the main line are among the highest reported, regardless of diameter. The total cost of $181,567 per mile exceeds even the cost of the 36-in. lines planned this year; it compares with $199,364 per mile for an unusually expensive 36-in. line completed during the past year.

The Montana-North Dakota line, at $38,925 per mile, represents favorable terrain with average laying conditions.

20 and 24-in. Construction

The usual expensive construction expected in West Virginia, whose rugged terrain earned one project the title of "toughest inch," is reflected in the 43.1-mile 20-in. line. Its total cost of $97,777 per mile is greater than either of the 24-in. projects shown.

The 24-in. line in Minnesota and Wisconsin has unit costs about 50% higher than the Oklahoma and Kansas project.

30 and 36-in. Construction

The 30 and 36-in. projects, for which estimates are carried on the last page of this cost report, are examples of what is currently expected for these diameters in good laying country.

The 30-in. cost per mile of $108,655 is just below the $112,242 average reported during the past year. It compares with the minimum of $78,913, which included an extremely low laying cost of $2.44 per foot, and a maximum of $116,919, which included a laying cost of $16.59 per foot, reported during fiscal 1960.

Current estimates for 30-in. loop lines planned for the Texas Gulf Coast range from $110,000 per mile to $123,000 per mile.

The 36-in. line in Kansas and Iowa, at $131,534 per mile, will probably be cheaper to build than the average for the diameter.

Current Laying Estimates

The following estimates of contract laying costs have been taken from cost exhibits of proposed gas lines (prices are per foot):

3-in.—$0.65 in Minnesota, $0.71 in South Texas.

4-in.—$0.83 in South Texas, $0.90 in Wisconsin, $2.36 on Texas coast.

6-in.—$1.05 in Wisconsin, $1.60 in Michigan, $1.66 in Illinois, $1.71 in Indiana, $1.80 in South Louisiana, $1.91 in Missouri, $2.11 in Ohio, $5.50 in South Louisiana.

8-in.—$0.95 in South Texas, $1.20

504.1-Mile 24-in. Line from Emerson, Man., to Marshfield, Wis. (continued)

Item	Material	Installation	Total
Weights (9,500 at 35/ton)	332,500	.....	332,500
Mississippi River crossing (2,600 ft.)	91,000	260,000	351,000
St. Croix River crossing (1,300 ft.)	45,500	78,000	123,500
Chippewa River crossing (1,300 ft.)	45,500	78,000	123,500
Misc. material (2%)	468,056	.....	468,056
Field engineering and inspection (2,000/mile)	.....	1,008,200	1,008,200
Total direct cost	.....	.....	40,611,185
General overhead (7% of direct)	.....	.....	2,842,783
Contingencies (6%)	.....	.....	2,607,032
Total	$23,870,835	$16,740,350	$46,061,000
Per Mile	$ 47,353	$ 33,208	$ 91,373

12.4-Mile 12-in. Line to West Delta Block 30, La.

Item	Material	Installation	Total
Right-of-way, damages	$.....	$ 11,928	$ 11,928
Preliminary survey	.....	12,400	12,400
Main-line pipe	293,180	344,400	637,580
Coating material, including concrete	212,544	.....	212,544
12-in. valve assemblies	6,000	.....	6,000
12-in. riser	.....	12,000	12,000
12-in. hot tap	.....	30,000	30,000
Platform	.....	9,000	9,000
Miscellaneous material (2% of total)	10,234	.....	10,234
Field engineering and inspection	.....	.....	31,000
General overhead (7% of direct cost)	.....	.....	74,897
Contingencies	.....	.....	62,417
Total	$ 521,958	$ 419,728	$ 1,110,000
Per Mile	$ 42,093	$ 33,849	$ 89,516

11.6-Mile 12-in. Line to East Cameron, La.

Item	Material	Installation	Total
Right-of-way, damages	$.....	$ 28,954	$ 28,954
Preliminary survey	.....	11,600	11,600
Line pipe	292,869	321,615	614,484
Coating material, including concrete	147,024	.....	147,024
Main-line valve assemblies (2)	6,000	.....	6,000
Highway, railroad crossings (160 ft.)	.....	19,200	19,200
12-in. riser	.....	12,000	12,000
Shore line plug	.....	10,000	10,000
Marsh plug	.....	16,000	16,000
Miscellaneous material (2% of total)	8,918	.....	8,918
Field engineering and inspection	.....	29,000	29,000
General overhead (7.7% of direct cost)	.....	.....	69,545
Contingencies	.....	.....	58,275
Total	$ 454,811	$ 448,369	$ 1,031,000
Per Mile	$ 39,208	$ 38,653	$ 88,879

in North Dakota, $1.73 in Illinois, $1.83 in Missouri.

10-in.—$2.35 to $5.70 in South Louisiana.

12-in.—$2.13 and $3.00 in Indiana, $5.25 in South Louisiana.

16-in.—$1.35 in Montana, $7.90 in South Louisiana.

20-in.—$7.25 in Pennsylvania.

24-in.—$2.07 in Oklahoma and Kansas, $4.75 in Minnesota and Wisconsin, $7.90 in Pennsylvania.

26-in.—$2.34 in Texas Panhandle, $10.22 in Alberta.

30-in.—$2.41 to $3.92 in Kansas, $2.92 to $3.38 in Illinois, $3.72 in Missouri, $4.40 in Michigan, $4.63 to $5.58 on Texas Coast, $5.05 to $5.58 in Louisiana, $10.05 in Pennsylvania, and $11.54 in Alberta.

36-in.—$5.56 in Kansas and Iowa, $5.69 in Louisiana, Mississippi, Alabama, Georgia and South Carolina, $8.59 in Alberta, $9.49 in Washington, Oregon, and Idaho, $10.89 in California, $13.89 in British Columbia, and $15.65 in New Jersey.

43.5-Mile 12-in. & 16-in. Line to Grand Isle, La.

Item	Material	Installation	Total
Rights-of-way, damages	$	$ 67,512	$ 67,512
Preliminary survey		38,628	38,628
Main line pipe	1,110,468	1,813,208	2,923,676
Coating material incl. concrete	790,440		790,440
Valves, drips, etc.	21,000		21,000
Highway crossings		7,200	7,200
Misc. installation			
12-in. risers		48,000	48,000
12-in. manifolds		5,000	5,000
16-in. risers		16,000	16,000
Plugs		28,000	28,000
Platform		57,380	57,380
Miscellaneous material (3% of detailed cost)	38,438		38,438
Field engineering and inspection			108,750
General overhead (7.7% of direct cost)			319,552
Contingencies			268,424
Total	$ 1,960,346	$ 2,080,928	$ 4,738,000
Per Mile	$ 45,065	$ 47,837	$ 108,920

17-Mile 10-in. Line to Bayou Chevreuil Field, La.

Item	Unit price	Total
DRY-LAND CONSTRUCTION (7 MILES)		
Transit survey and mapping	$471.43	$3,300
Right-of-way and damages	25.000	56,000
Total		$59,300
Material cost		
Pipe	3.00	110,880
Coating material		
Primer	1.20	300
Enamel	75.00	5,250
Glass wrap	1.00	1,300
Valve installation		
Valve and fitting tie-in assembly	2,500.00	5,000
10-in. block valve assembly	3,500.00	3,500
10-in. side valve assembly	3,500.00	7,000
Highway and railroad crossings		
Road casing—14-in. pipe	4.05	1,215
Fence stiles, line marker posts, vent pipe and misc. material		1,500
Highway markers, shell for road repair, etc.		6,000
Cathodic protection—equipment and materials	150.00	1,050
Total materials		$142,995
Installation cost		
Main line construction	2.35	86,856
10-in. valve tie-in	2,500.00	5,000
10-in. block valve assembly	2,500.00	2,500
10-in. side valve assembly, etc.	2,000.00	4,000
Highway and railroad crossings	15.00	4,000
Cathodic protction	175.00	1,225
Total installation and materials		306,376
Engineering and supervision		9,191
Total dry land construction		$315,567
MARSHLAND CONSTRUCTION (10 MILES)		
Transit survey and mapping	900.00	9,000
Right-of-way and damages		80,000
Total		$89,000
Material cost		
Pipe	3.00	158,400
Coating material		
½-in. somastic and 1-in. concrete overcoat	1.35	71,280
Road casing—14-in. pipe	4.05	405
Fence stiles, line marker posts, vent pipe, and misc. material		500
Cathodic protection—equipment and materials		1,500
Total materials		$232,085
Installation cost		
10¾-in. o.d. main-line construction	3.90	205,920

17-Mile 10-in. Line to Bayou Chevreuil Field, La. (continued)

Item	Unit price	Total
14-in. casing	30.00	3,000
Cathodic protection	175.00	1,750
Engineering and supervision		15,953
Total—Marsh-land construction	$54,771.00	$547,708
Total—Dry land construction	$45,081.00	$315,567

22.7-Mile 16-in. Line in Montana and North Dakota

Item	Unit price	Total
Material		
Line pipe	$ 4.91	$ 589,200
Casing pipe	6.50	1,300
1,000 gal. pipeline primer	1.20	1,320
820 drums pipeline enamel	27.00	22,140
6,000 squares glass inner wrap	1.30	7,800
6,000 squares asbestos felt wrapper	2.00	12,000
3—16-in. aboveground valve settings		23,000
Casing seals and spacers		320
Marker posts, signs and miscellaneous		520
Farm line caps and extensions		3,000
Total material		$ 660,600
Labor		
Contract labor for clearing right-of-way, ditching, stringing, welding, coating, laying, backfilling and cleanup for 120,000 ft. of 16-in. pipe	$ 1.35	$ 162,000
Fabrication of valve settings and installation		1,600
Casing installation	15.00	3,000
Total labor		$ 166,600
Survey and mapping (22.7 miles)	$ 200.00	$ 4,540
Right-of-way	150.00	3,400
Supervision and inspection		22,700
Contingencies		25,760
Total	$ 38,925.00	$ 883,600

7.03-Miles 16-in. Line in New Jersey

Item	Unit price	Total
Right-of-way, damages (2,250 rods)	$ 132.50	$ 298,125
Line pipe 16-in. x .312-in. X 42 (37,470 ft.)	5.31	198,966

7.03-Mile 16-in. Line in New Jersey (continued)

Item	Unit price	Total
Other materials		77,335
Install 16 in. line (37,100 ft.)	15.00	556,500
Other installation		75,189
Surveys, field engineering, and supervision (7.03 miles)	10,000.00	70,300
Total	$181,567.00	$ 1,276,415

43.1-Mile 20-in. in West Virginia

Item	Total
Grading and clearing right-of-way	$ 318,600
Unloading, hauling, and stringing pipe	125,200
Excavating and grading trench	568,900
Bending, welding, laying, and lowering pipe	500,700
Coating	295,800
Backfilling, repairing fences, and cleaning up rights-of-way	113,800
Blowing, testing, and purging	11,400
X-ray, gate settings, extra work, concrete and sleeves	74,100
Cost of survey	17,200
Line pipe	1,473,500
Valves, fittings, and miscellaneous material	232,700
Direct labor	86,100
Gas cushion and purging	8,600
Rights-of-way, damages	89,000
Interest and overhead	73,300
Stores, hauling, and miscellaneous	225,300
Total	$4,214,200
Per mile	$97,777

180-Mile 24-in. Line in Western Oklahoma and Kansas

Item	Unit price	Total
Material		
Pipe (180 miles)	$38,482.14	$6,926,785
Coating and wrapping	1,320.91	237,764
Highway and railroad casings (20)	1,600.00	32,000
Manual valve settings (11)	9,000.00	99,000
Drips (4)	1,500.00	6,000
River weights (500)	72.10	36,050
Miscellaneous material	407.77	73,398
Use tax		156,483
Mill inspection (pipe, 30,530 tons)	0.50	15,265
Gas lost, blowdowns, purge, test, line pack (180 miles)	248.64	44,755
Total material	$42,375.00	$7,627,500
Right-of-way, damages		
Oklahoma (139.10 miles)	2,080.00	289,340
Kansas (40.90 miles)	2,400.00	98,160
Total right-of-way, damages	$2,152.78	$387,500

180-Mile 24-in. Line in Western Oklahoma and Kansas (Continued)

Item	Unit price	Total
Installation		
Contract—construction (180 miles)	10,972.68	1,975,083
Contract—nondestructive testing	203.31	36,595
Contract—survey	308.82	55,588
Aerial photography	25.00	4,500
Company—inspection	952.17	171,390
Company—construction	10.24	1,844
Total installation	$12,472.22	$2,245,000
Total direct cost	$57,000.00	$10,260,000
Engineering, general and administrative (2.5%)		256,500
Interest during construction (1.5% of total)		153,900
Contingencies (5%)		513,000
Total	**$62,130.00**	**$11,183,400**

371.4-Mile 30-in. Line in Texas, Arkansas, Missouri, and Illinois

Item	Unit price	Total
Material		
Pipe (30-in. x .344-in. X52—1,961,000 ft.)	$ 11.23702	$22,035,791
Coating and wrapping (1,961,000 ft.)	0.40586	795,897
Railroad and highway casing (90)	1,525.00	137,250
Main-line valves (31)	21,500.00	666,500
Station connection (1)	13,000.00	13,000
Station connection (5)	42,500.00	212,500
Loop end crossover (13)	16,600.00	215,800
Intermediate crossover (20)	8,900.00	178,000
River weights (2,000)	100.00	200,000
Extra cost of river crossings (10,350 ft.)	5.38164	55,700
Misc. material, freight (371.4 miles)	1,500.00	557,447
Sales tax (Illinois only—3.5%)		117,117
Gas lost—blowdown, purge, test (371.4 miles)	500.00	185,700
Total material		$25,430,700
Right-of-way, damages		
Texas (105.84 miles)	$ 3,840.00	$ 406,280
Arkansas (126.42 miles)	3,840.00	485,225
Missouri (64.54 miles)	4,800.00	309,565
Illinois (74.6 miles)	5,760.00	429,930
Total right-of-way, damages		$ 1,631,000
Installation (371.4 miles)		
Contract—construction	$ 24,475.00	$ 9,090,200
Contract—survey	280.00	104,000
Contract—X-ray	210.00	78,000
Company—inspection	1,145.00	425,300
Company—construction	1,125.00	417,800
Total installation		$10,115,300
Total pipeline		$37,117,000

371.4-Mile 30-in. Line in Texas, Arkansas, Missouri, and Illinois (continued)

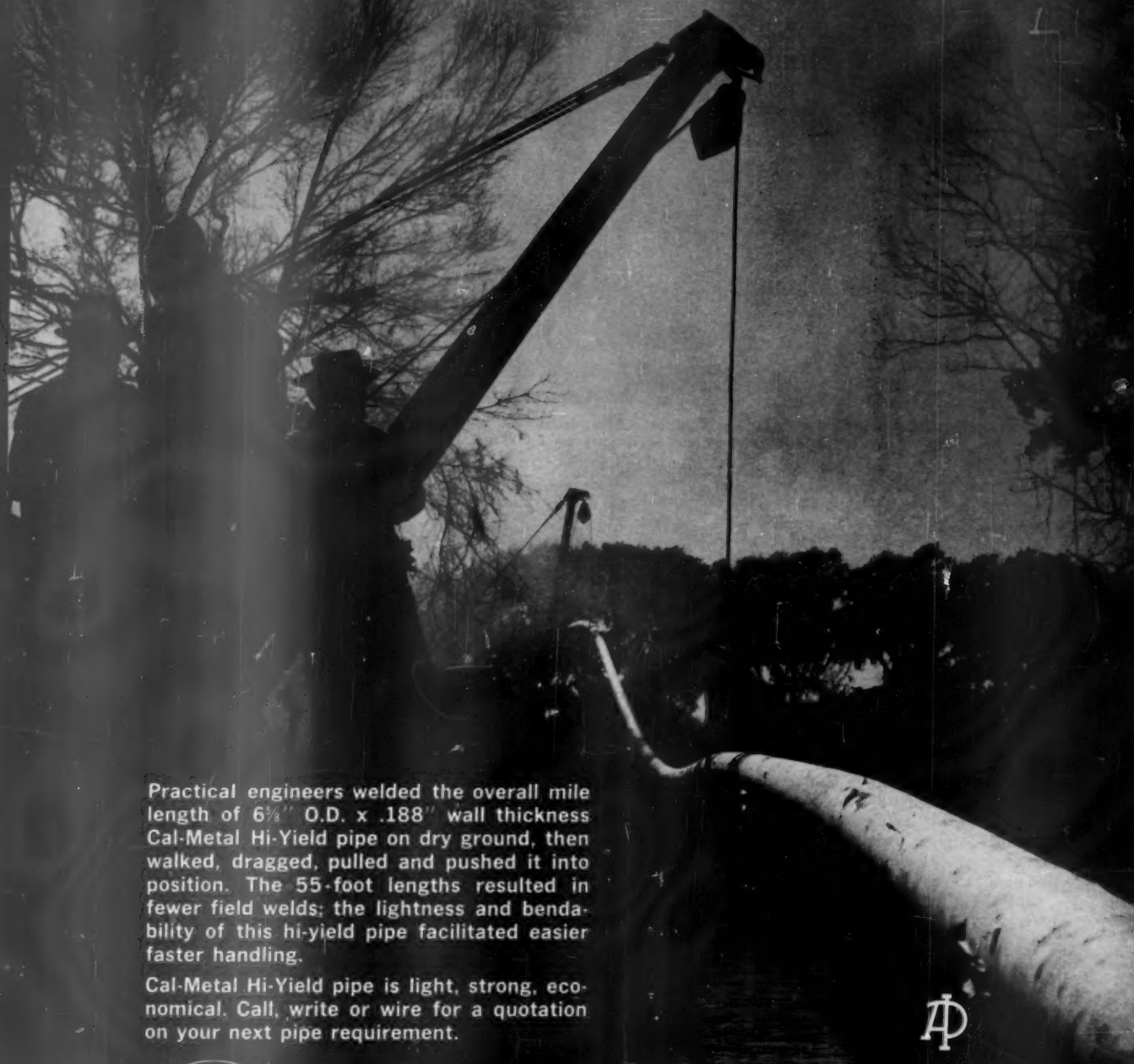
Item	Unit price	Total
Engineering, general, administrative (2.5%)		827,925
Interest during construction (1.5%)		555,755
Contingencies (5.0%)		1,853,850
Total	**$108,655.00**	**$40,354,530**

151.21-Mile 36-in. Line in Kansas and Iowa

Item	Unit price	Total
Material		
Pipe (151.21 miles)	$75,411.35	$11,402,950
Coating and wrapping	2,573.72	389,172
Highway and railroad casings (36)	3,050.00	109,800
Loop end and river crossIntermediate crossovers (6)	18.000.00	162,000
Intermediate crossovers (6)	9,000.00	54,000
Automatic valve settings (7)	24,000.00	168,000
Station block valves (3)	18,500.00	55,500
Station connections (7)	23,500.00	164,500
Drips (6)	2,200.00	13,200
River weights (224)	156.34	35,020
Miscellanous material (1% of total—151.21 miles)	779.73	120,927
Use tax		278,776
Mill inspection (pipe—52,708 tons)	0.50	26,354
Gas lost, blowdown, purge, test, line pack (151.21 miles)	373.00	56,401
Total material	$86,215.00	$13,036,600
Right-of-way, damages		
Kansas (59.47 miles)	2,400.00	142,720
Iowa (91.74 miles)	3,040.00	278,880
Total right of way, damages (151.21 miles)	$2,788.18	$421,600
Installation		
Contract—construction	29,385.58	4,433,394
Contract—nondestructive testing	221.71	33,525
Contract—survey	330.80	50,020
Company—inspection	917.43	138,725
Company—construction	814.34	123,136
Total installation	$31,669.86	$4,788,800
Total direct cost	$120,673.24	$18,247,000
Engineering, general, and administrative (2.5%)		456,175
Interest during construction (1.5% of total)		273,705
Contingencies (5% of total)		912,350
Total	**$131,534.00**	**$19,889,230**

PIPE BY THE MILE...

. . . IN ONE PIECE, WALKED INTO PLACE IN RUGGED SWAMP TERRAIN.



Practical engineers welded the overall mile length of 6⅝" O.D. x .188" wall thickness Cal-Metal Hi-Yield pipe on dry ground, then walked, dragged, pulled and pushed it into position. The 55-foot lengths resulted in fewer field welds; the lightness and bendability of this hi-yield pipe facilitated easier faster handling.

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DIGITAL-CONTROL COMPUTER, left, has input-output cabinet in center, with the operator's console. The transistorized RW-300 has built-in analog-to-digital conversion equipment, an 8,000-word magnetic drum memory unit, and modular construction.

How and where to use control computers

for petroleum processing

BY JAMES W. LANE AND
R. CURTIS JOHNSON
Thompson-Ramo-Wooldridge
Products Co.
Beverly Hills, Calif.

These authors declare:

"For a process-control computer to accomplish anything useful, the program stored in its memory must make logical operations upon properly received signals. The computer must transmit output signals to the right locations, and must demand the correct actions of the final control elements at the proper times."

ON-LINE digital computers show much promise for the optimized control of petroleum-processing plants. Studies show possible substantial operating and economic benefits when applied to crude distillation, catalytic cracking, catalytic reforming, butane isomerization, alkylation, polymerization, and solvent extraction.

But the installation of the computer is a long and painstaking project which involves:

1. Mathematical analysis of the process.
2. Engineering of the computer control system for the particular job.
3. Careful programing of the computer.
4. Checkout of computer and program.
5. Gradual closing of the loops, with adjustment of the program and instrument settings until proper operation is obtained.

About 5 to 10 man-years of team work is required to perform the entire project process.

Model needed. For a process-control computer to accomplish anything useful, the program stored in its memory must make logical operations upon properly received signals. The computer must transmit output signals to the right locations, and must demand the correct actions of the final control elements at the proper times. Therefore, a mathematical model of the process must be produced which accurately describes both feed-forward and feedback aspects of the control system.

The resultant actions of the computer in establishing final control must be carefully predicted in order to write the control program, and the model must be properly tested before such a machine is actually installed on the process.

A brief preliminary survey of a process, taking from 2 to 6 man-

weeks, is needed to show whether a mathematical model can be produced, what variability in the process may be eliminated, what the approximate system cost will be, and what return on investment can be expected. Assuming prospects are good, arrangements are made for eventual installation of a system and a detailed study is begun.

To produce and test the model, a study team of men from both the operating company and the computer-engineering company must spend 3 or 4 man-years. When this model has been proved out, it will be possible to predict the performance and compare it with that obtained without a computer control system. By putting dollar values on the improved performance, a good estimate can be made of the money to be saved. The model, system description, computer functions, and economics are all summarized in a formal report.

Building the system. A new group assumes responsibility at this point. These men are specialists in electrical engineering, instrumentation, and physics. It is their job to see that each connection, wire, shielded cable, transducer, instrument, etc., is properly specified; the details are worked out; a special console is produced where necessary; and the entire system is tested and installed in the plant.

While these project engineers are performing the necessary engineering work for the specific computer, the programing group is working on the actual program which will be stored in the memory of the machine. This is the program which tells the machine to, (1) perform the specific operations to solve the equations derived from the model, (2) perform the necessary optimization, (3) store the information for output signals in the proper locations, and (4) perform all other alarm, scanning, and logging functions which the purchaser may require. These two groups work together, along with assistance as necessary from the group which originally produced the model.

In all these activities people from both companies work together. The men who do the original mathematical work frequently include people from research, operations, and instrumentation. In the actual installation in the plant, more operating personnel are called in, because it is their final responsibility to operate the computer. Usually some persons from the operating company are trained in the general philosophy and theory of operation of digital computers, and in the programing of the specific computer which has been purchased.

In this manner, even if they do not become sophisticated programers, they are able to keep their programer up-to-date. Three or four man-years are probably necessary to carry out the project engineering and programing. Once the specific computer system has been produced, it is thoroughly tested by maintenance engineers before being shipped.

FIRST chemical process to be controlled by computer is the B. F. Goodrich Chemical Co. installation in Calvert City, Ky. The computer scans, logs, and controls two distinct chemical processes.

Computer checkout. Once the computer is received at the final location, a procedure which is closely akin to plant startup is entered upon. It is not possible to install even a relatively simple instrument, make the necessary connections, flip the switch, and walk away from it. You are not able to predict with necessary accuracy the response of a minor loop in a process so that you can set an instrument once and for all and expect it to work exactly as anticipated.

At times there are difficulties within the instrument. More frequently, however, the adjustment of settings and careful watching of the process for a short time are all that are necessary to see that the instrument is working properly.

With a computer control system which encompasses large sections of the plant, including many minor loops, there are difficulties associated with automatic control of minor loops compounded by the larger scope problem, and the interreactions of the minor loops with each other. It is desirable, therefore, for us to use a startup procedure in which the computer is hooked to the inputs from the process but the outputs are not fed back as signals to the process.

The computer is allowed to run open-loop with its program in operation, and displays are made of the instrument settings which the computer predicts should be used. When these settings appear reasonable, the actual instruments are set by hand and the progress of the process is followed. As it becomes evident that the process is responding properly to computer control—implemented by manual means—the various loops are closed one by one.

As the operation is followed and it is detected that the process is remaining stable, all of the loops may be closed. The job is considered complete when a set of acceptance tests has been passed satisfactorily. At any point where instabilities arise it is possible to place the plant back on normal automatic or manual control, and to test portions of the computer program where difficulties appear to arise.

Petroleum-Processing Applications

A very logical question is: Where do we feel on-line digital computer control will be of value within the petroleum industry? We have worked through projects—to varying degrees of completion—involving crude stills, catalytic cracking, catalytic reforming, butane isomerization, sulfuric acid alkylation, hydrofluoric acid alkylation, polymerization, solvent extraction, and integrated distillation units.

Crude-still operation. The crude still is subjected to feeds of varying qualities, particularly where distinctly different crude shipments such as those transported by barge are used. Thus, there are some uncontrollable, independent variables. It is also true that in the over-all refinery production scheduling, which is generally carried on by means of off-line, large-scale digital computers performing linear programing calculations, the demands for the various streams which can be taken off the crude tower vary from time to time. This is an economic consideration.

In addition, variations in the performance of refinery equipment, including emergency shutdowns of certain units, require alteration of the

method of operation of the crude tower. We have made a preliminary estimate that the potential savings in a crude tower running 50,000 bbl. of crude per day might run to $700,000 per year if better control could be exercised. We have not yet written a model for a crude tower.

Catalytic cracking. There are several types of catalytic crackers, each with its own peculiar problems. The problem may even be quite different for two similar units because of differences in feed and objectives.

Catalytic crackers, because of their high throughput and premium quality products, are real money makers. As a result of this, a small improvement in operation will yield a handsome profit.

There are not many variables which can be manipulated in a catalytic cracking unit. Furthermore, the construction of a model is not easy. We are approaching the writing of a model from a combined theoretical and practical viewpoint.

Catalytic reforming. The catalytic reforming unit occupies a unique position in the modern refinery. It is a necessity for producing the up-to-date high-octane gasoline. At the same time it is an expensive luxury. This unit produces a high-octane aromatic reformate from low-grade paraffinic and naphthenic naphthas, but at a considerable loss in yield. The operating cost for a typical catalytic reformer is quite high due to the catalyst used.

As characteristics of the crude entering the refinery, the performances of other units, and gasoline-blending schedules change, corresponding adjustments are made in the product quality and rate from the catalytic reformer.

Usually the two methods of increasing the octane barrels in the gasoline pool are either increased reformer severity or increased lead (TEL) level. The incremental cost of both of these methods must be balanced against each other and the optimum of each found.

Once optimum severity and throughput are dictated for the reformer, deviation in either direction from this costs money; either lead costs are too high or there is too much catalyst cost and yield loss.

The job of the on-line computer would be to choose the optimum level of each of the controllable independent variables for the various combination of uncontrollable variables which produces the desired severity and feed rate. The most important uncontrollable variable is the feed composition. This in many cases is varying continually.

The most important controllable variables are the reactor inlet temperatures. It would be the computer's job to select the set of temperatures which give the optimum balance between catalyst life and yield.

In the feed-forward system we have outlined, the computer would attempt to produce a constant-octane product by continuously analyzing the feed composition, plugging this and the catalyst characteristics into a predictive model, and coming up with the temperatures required to produce this octane. The actual octane of the product would be fed back to the computer so that adjustments might be made to the model.

Butane isomerization. This is a process which we have studied in some detail. In a sense, this is a different type of process from others in a refinery, in that the catalyst-replacement problem is of primary importance[5 6]. With many other units, the catalyst might have to be replaced every year or so, or—in the case of alkylation—the catalyst is continually fed to the system and in some cases regenerated.

In fluid catalytic cracking, regenerated catalyst is continually fed to the reactor and coked catalyst is fed to the regeneration unit, while make-up is fed to the system periodically. In butane isomerization, however, we have an intermediate case where catalyst must be replaced several times a year. In addition, several variables may be manipulated to maintain the desired purity and amount of isobutane.

With frequent variations in the composition of feed to such a unit, it is desirable to adjust the temperature and promoter concentration as well as the flow rate. These are varied in order to maintain the desired quantity and purity at the lowest possible cost and subject to the slowly varying activity of the catalyst. Several studies from our group have been devoted to allocation of streams in the case of multiple units. We feel that we may very well make use of some advanced optimization techniques in solving this problem if it appears that there is sufficient economic promise in doing so.

Alkylation. Both sulfuric acid and hydrofluoric acid alkylation appear likely candidates for optimization using on-line digital computers. In both processes there are sufficient variables to be manipulated, and based upon the data which we have examined, there appears to be enough variability in the composition of feed to such units that frequent control action is a desirable thing.

Changes in cooling-water temperature also represent an uncontrollable variable here.

Polymerization. The first working installation of an RW-300 was on a catalytic polymerization unit at Texaco. The problem has been described to some extent in the literature[2 3]. With parallel units it is desirable to be able to allocate varying amounts of flow to these units in order to obtain approximately the same degree of reaction regardless of the age of the catalyst and, therefore, the catalyst activity in these units.

To perform an optimization of this set of units, it has been necessary to produce a mathematical model, based on plant data, which describes in sufficiently accurate detail the effects of the numerous variables in the system. Such variables include the flow rates to the various units, the water content of the gases being fed, and the temperatures which are dependent upon amount of reaction and upon the amount of quench which is fed into the system.

Solvent extraction. In some solvent-extraction processes the quality of the feed is established outside the unit. The maximum available solvent rate changes with time as the solvent-recovery system heat-exchanger characteristics change. (Note here a similarity to slow change in catalyst activity.) Another variable of primary importance which the operator cannot always control is the extraction temperature.

The process yield and throughput, as well as product characteristics, are dependent in a very complicated way upon feed quality, extractor temperature, fresh-feed rate, and solvent rate. The control system must maintain best possible operating conditions (highest production of on-grade product) in the face of these variations.

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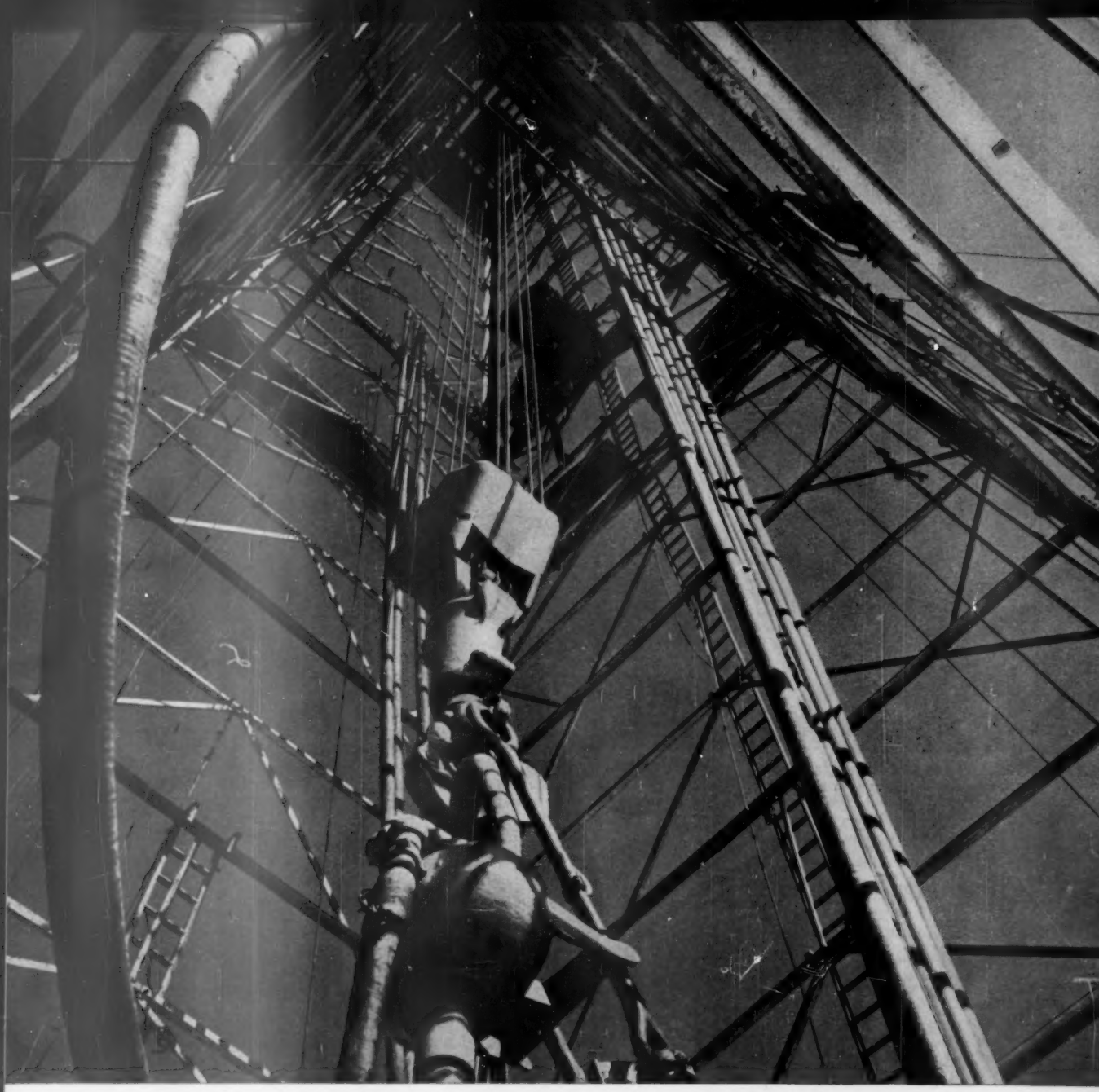


Bethlehem Wire Rope at Work in North Goldsmith Field. This photograph was taken during drilling of a 13,000 ft well in the North Goldsmith Field, Ector County, Texas, by Falcon-Seaboard Drilling Company. At the time of the picture, the drilled depth was 7,000 ft. The Bethlehem wire rope used here is 1¼ in. 6 x 19 Seale Formset Purple Strand, right lay, with IWRC. As usual, the Bethlehem rope provided low cost, dependable service. And that's one good reason why it is used so extensively throughout the oil country.

Bethlehem Steel Company, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem wire rope

BETHLEHEM STEEL

TUNGSTEN-CARBIDE-FACED CUTTERS (2 of the 3) are visible in this section mill. In operation, the blades are forced up inclined planes in the body pockets to contact the casing wall. After cutthrough, the blades are rigid in tops of pockets and ride down on top of casing, milling away the steel as they go.

Where and how the

Section mill can save you important money

BY CLARENCE LEATHERS
Executive Engineer, Grant Oil Tool Co., Los Angeles

THE MODERN section mill has cut cost of several types of well rework jobs by at least 25%.

The tungsten-carbide-faced section mill has been in use only a very few years; in that time, it has made much more attractive the reworking of old wells choked off by mechanical failure or excessive sanding. This new tool has also proved valuable in new completions where there are intermediate water sands between oil zones. In addition the section mill may be used to whipstock a drilling well from inside casing.

There are two approaches to using the section mill in redrilling old wells. One situation calls for milling out a section above the producing formation, setting a retrievable whipstock, and drilling a new hole back into the zone. In this instance, it may be desirable to make a water shutoff test and, if wet, squeeze with cement.

The second approach is to plug back to an oil-bearing formation which was bypassed and cased off in the original program. A section is milled and the wall scraped to expose the formation face. Completion may be made by any conventional method. The new zone is then produced directly into the well or a screen liner may be set.

Formerly, when producing formations with intermediate water zones were to be exposed, it was necessary to swage in with expensive alloy pipe at the oil zones. Then, the driller came back into the hole with a conventional mill to cut away the swaged sections. Now, with the tungsten-carbide mill, it is possible to cement conventional casing straight through to bottom and then mill away the sections opposite the producing formations. This leaves the water sands blocked off by a sleeve or sleeves of casing.

A service rig may now do section milling if it is equipped with a rotary table. Tubing may be used as drill string; in case it is, two or three drill collars and a stabilizer should ride above the mill to provide cutting weight and steadiness.

Simple construction, operation. An experienced driller can operate a sectional mill easily after he is instructed in a few points developed through past experience.

There are a number of sectional mills available. The principle of all designs calls for hydraulic pressure to force the cutters out into contact with the casing. As the tool is rotated, hydraulic force is maintained and the blades are impelled to cut through the pipe. The tool then sits on top of the section and mills down in a conventional manner.

One of the latest designs which was developed specifically for section milling has only four moving parts—a hydraulic piston and three cutter blades which are driven up inclined planes by the piston to contact the casing wall. The following suggestions are based on this particular section mill:

Starting the cut. Due to mismeasurement, stretching of pipe, or subsurface movement, the casing collar at the top of the desired section may sometimes be several inches or feet above or below where it is supposed to be. To locate the starting point, lower the tool until it is a short distance above the estimated depth of the collar.

Start circulating with sufficient pressure to force the blades up into contact with the wall but not enough to dig into the metal. Then, lower the tool slowly. When the blades, sliding down the wall of the casing, come to the joint of the collar, they will automatically expand into the recess. They will then catch on top of the pipe joint at the bottom of the collar.

With the collar thus located, stop circulation and raise the tool until it

THIRTY feet in one trip is the record of these three sectional-mill blades in milling out casing in a California well. Tungsten carbide fragments do the work. Cutters mill by riding down on casing after cutting through the wall under force of hydraulic pressure.

strikes the joint at the top of the collar. This forces the blades back down into the body. Then, set the tool at the desired depth, start the pumps and rotate the string. Continue this without applying weight until the blades have completed a cut through the casing.

Usually a driller can tell by the change in the "tune" of his surface equipment—or from the vacuum gage, if he uses a gasoline engine—when the mill has finished cutting through the steel and is grinding away the cement. At this point, weight should be applied until the tool has progressed about a foot. The driller should allow about an hour, for instance, to cut through and mill down a foot in J-55 casing of 7 in., 17 to 30 lb.; 8⅝ in., 32 to 45 lb., or 9 in., 40 to 55 lb.

Stop for a test. Before cutting further, it is always advisable to make a double check to be absolutely sure the tool has milled through the casing. Some have assumed that the cut-through was made because the tool took weight, only to learn from fine, stringy cuttings coming out of the hole that the tool was merely shaving the inside of the casing.

Test by stopping rotation and putting weight on the tool. If it takes weight without sliding down the hole, this is good indication that the blades are out of the pipe.

This test, however, is not always reliable. So, a second check is made by starting the pumps and raising the tool to the top of the cut with a pull of about 2,000 to 3,000 lb. This is not enough pull to overcome the hydraulic action holding the blades out of the tool body, but if the blades catch and hold under this much tension the driller may be sure that the section mill is indeed ready for downward progress.

As the tool is lowered to the top of the pipe, rotation is started and pump pressure is continued. This forces the blades out to the maximum open position possible by the drive of the piston alone. Applying weight then takes the cutters to the tops of their body pockets in their best operating position.

Best weight, speed. The driller will soon be able to tell from the operation of his equipment what rotary table speed and how much weight will be best. Too much weight actually slows milling of steel while it speeds wear of the cutters. Too fast rotation also wears blades excessively and causes unsatisfactory cutting.

Generally speaking, a section is milled at 70 to 120 r.p.m., depending on the type, weight, and size of the casing. Weight should be applied gradually, until the driller senses that the tool is working well and a substantial volume of shavings from the hole bears out his judgment.

These cuttings usually are fine at the start and become coarser as the job progresses. They vary with the casing being cut, of course. The metal chips from a collar are always heavier than the casing cuttings. They resemble wood whittlings; being arc-shaped and broader than pipe chips.

Milling should progress no faster than 4 or 5 ft. an hour. Reason is that most of the cuttings must be recovered from the hole. If produced too fast, the shavings may form a "nest" above the section and thus stick the string when it is withdrawn from the well. The mill turns out 1,080 lb. of steel chips from a 30-ft. section of 36-lb. casing, and clearance for the passage of drilling fluid is necessarily limited. Thus, it is obvious that the driller must not create cuttings faster than the mud can carry them out. At 4 or 5 ft. an hour, the cuttings come out properly.

Getting cuttings out. Under some conditions, many of the cuttings remain in the hole and drop to bottom. If an extremely long section is to be milled, the depth below the section must be taken into account. If there is too little space below the section, shavings may collect and stop the tool. The weight would be taken on the cuttings rather than on the blades. If it is impractical to allow sufficient room below the section, the driller must, of course, watch for signs of obstruction. If necessary, he should run a bit into the hole to stir up the cuttings so they can be circulated out before milling resumes.

After the milling job is finished, the driller must continue to circulate the hole until shavings stop coming out. This prevents metal from clogging the wall scraper as it is lowered into the well to complete the job of preparing the section. If the bottom orifice of the wall scraper should become plugged with metal, the hydraulic expansion mechanism would be unable to open the blades.

Cost of chemicals outside U.S.A.

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

THE COST of chemicals used in U. S. refineries was discussed in previous installments of Process Costimating. During 1956 the per barrel costs were about:

Chemicals	10.7 ct./bbl.
Tetraethyl lead	9.8 ct./bbl.

Somewhat the same average costs are encountered by refiners throughout the world. However, refineries situated far from the source of chemical supplies will encounter larger costs. Nearly all chemicals are cheaper in Europe than in the United States and in each area of the world one or another of the chemicals is usually cheaper than the United States.

Although the cost of delivered tetraethyl lead throughout the world is only slightly higher than in the U.S.A., a smaller quantity of TEL is used in most foreign gasolines. (See data tabulation below.)

As a gross approximation, the amount of tetraethyl lead found to be economical or used in the U.S.A. since the war (1949 to date) is related to octane number somewhat as:

cc. TEL	Res.	Motor
1.0	....	75
1.5	79.5	75.5
2.0	86.5	80.5
2.5	94.5	85.5

TEL usage as related to octane number should be somewhat the same elsewhere in the world except that import duties or adverse currency exchange rates generally tend to discourage the use of tetraethyl lead. Finally, the amount of TEL used in the U. S. since 1930 indicates that it is economical to raise the clear octane number by about 11 units research nearly irrespective of octane level. However, during recent years the increase has been nearer 9.7 units and during 1956 only about 9.2 units.

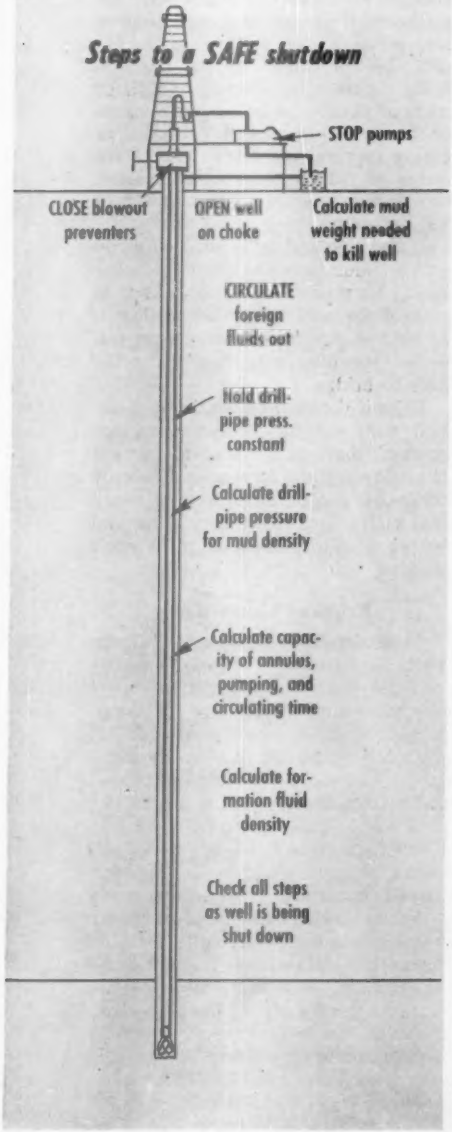
TABLE 1—OCTANE NUMBERS OF FOREIGN GASOLINES

	Leaded (1948)*			Representative, Res. O.N.†					
				Dec. 1955		Dec. 1956		1959	
	Res.	Motor	cc. TEL	Reg.	Prem.	Reg.	Prem.	Reg.	Prem.
Africa, French North	....	‡64-66	....	....	....	....	....	....	....
Africa, South and East	....	70	....	79-80		79	90	....	....
Africa, West	....	70-72	....	....	....	....	....	....	....
Argentina	§76	§70-72	....	72-74		75.0		....	....
Australia	....	72	....	79-80	90-91	79	90	....	....
Antilles	80	76	....	....	....	....	....	....	....
Belgium	75.3	71.2	0.89	83-84	91	84-85	92-93	84-88	93-97
Bermuda	‡75	‡70	....	....	....	....	....	....	....
Bolivia	....	§70-72	....	....	....	....	....	....	....
Brazil	80	75	....	79-80	90-91	79-80	90-91	....	....
Caribbean	80	75	....	....	....	....	....	....	....
Canary Islands	....	‡65-68	....	....	....	....	....	....	....
Canada	....	....	....	87.5	94.6	89.5	95.6	....	....
Central America (Carib.)	80	75	....	....	....	....	....	....	....
Central America (Pacific)	75	75	....	....	....	....	....	....	....
Chile	70-71	70-71	....	....	....	....	....	....	....
Colombia	§80	§75	....	....	....	....	....	....	....
Cuba	79	74-76	....	90-94		88-94	95-97	....	....
Denmark	78.5	74.4	1.04	82-84	91-93	83-84	91-93	82-86	91-94
Egypt and Libya	....	70	....	....	....	....	....	....	....
Finland	74.8	71.1	0.57	....	....	....	....	79-87	94-95
France	....	65	1.9	78-79	88-89	80	90	80-83	90-94
Germany (local)	....	‡62.5	....	83-86	90-92	86	95	86-89	95-98
Germany (military imports)	....	71.2	0.58	....	....	....	....	....	....
Guianas	80	76	....	....	....	....	....	....	....
Greece	....	70	....	....	....	....	....	....	....
Iceland	....	70	....	....	....	....	....	....	....
India and Far East	....	70	....	78-79		79.0		....	....
Italy	....	60	1.14	82-84	90-93	85	98	84-26	98-100
Japan	....	....	....	74-78	83-91	80	88	....	....
Middle East	....	70	....	....	....	....	....	....	....
Mexico	§73	§67	....	70	80	70	80	....	....
Netherlands	‡74	‡69.3	....	84	91	84	92	83-85	90-94
New Zealand	....	....	....	79-80		79-80		....	....
Norway (regular)	76	71.8	0.71	....	....	....	....	79-83	....
Norway (premium)	86	78	1.95	....	....	....	....	....	92-94
Puerto Rico	80	76	....	....	....	....	....	....	....
Paraguay	....	‡63-65	....	....	....	....	....	....	....
Peru	§75-88	§68	....	....	....	....	....	....	....
Philippines	....	....	....	80.0		79	90	....	....
Portugal	....	72	....	....	....	....	....	....	....
Spain	....	‡64-66	....	69	79	73	80	77-79	90-92
Sweden	78.3	73.3	0.7	83-84	93	83	93-95	83-85	93-94
Switzerland	....	74.8	0.9	83-84	93	83-84	93	85-89	94-99
Trinidad	80	76	....	....	....	....	....	....	....
Turkey	....	70	....	....	....	....	....	....	....
United Kingdom	....	70.8	0.44	76-80	94-96	79-80	95-96	80-85	95-98
United States	....	....	....	88.9	96.1	90.4	97.3	91.9	99.1
Uruguay	70-83	69-80	....	....	....	....	....	....	....
Venezuela	77	74	....	81	95	77	95	....	....

*Schoenbaum, G. H., Heavy European Motor Fuel Demand . . ., The Oil and Gas Journal, June 24, 1948, p. 142. †Ethyl Corp., Annual Reviews of Gasoline Quality, 1955 and 1956; and The Oil and Gas Journal, July 20, 1959, p. 65. ‡Unleaded. §Unleaded gasolines also marketed,—Research octane numbers 10-14 units lower, and Motor 5-10 units lower.

WHAT TO DO IF BLOWOUTS THREATEN WHILE DRILLING

BY T. E. O'BRIEN,
Gulf Oil Corp., Houston, and
W. C. GOINS, JR.,
Gulf Research and Development Co.,
Harmarville, Pa.


Steps to a SAFE shutdown
STOP pumps
CLOSE blowout preventers
OPEN well on choke
Calculate mud weight needed to kill well
CIRCULATE foreign fluids out
Hold drill-pipe press. constant
Calculate drill-pipe pressure for mud density
Calculate capacity of annulus, pumping, and circulating time
Calculate formation fluid density
Check all steps as well is being shut down

WHEN a drilling well starts to flow, closing the blowout preventers is probably the most important single action. Even this must be done in an orderly fashion to prevent damage to the preventers or to the hole.

The preventer system should have one flow line and one choke open during drilling. To prevent their becoming plugged, it is necessary to pump through both frequently. This arrangement allows us to close the well in easy stages. That is, the preventer is closed, then the flow line, and finally the choke. While these are being closed, the pump is being shut down but the drill pipe is kept in motion. This entire operation should require no more than 1 minute, or at most 2 minutes.

There are two reasons for this method. First, if the kick is severe, the mud rising in the annulus has high momentum and can easily loosen flange bolts if the well is closed in suddenly. Second, if the pump is not shut down as the well is closed in, pressure can build up high enough to break down the formation and cause loss of circulation.

Once the well is completely closed in, follow the method outlined below until the well is killed and normal operation can continue. It is imperative that the well be reopened on choke and the pump started as soon as possible!

With normal pumping rates and expected annular pressures, the following positive choke sizes are necessary with our proposed method. For very deep wells, when drilling 6-in. (more or less) holes, a ⅛-in. choke is necessary. For all others the smallest should be ¼ in., increasing in ⅛-in. increments to ¾ in. Above ¾ in., only 1 and 1⅛-in. chokes are required.

To gain or not to gain. Many believe that in killing a well the pit level must be kept constant. That is, they allow no apparent gain in the pit. This concept is grossly in error. In fact, in many instances it is impossible. If the fluid entering the hole were always water, this idea could be followed. However, if the fluid is gas, it must be allowed to expand as it rises in the hole. If not, the gas will be under the same pressure at the surface as it was when it entered the hole.

Therefore, if the fluid entering the hole contains gas, it must be allowed to expand as it approaches the surface. This causes an apparent gain in the pit. More mud will be flowing out of the well than is being pumped in.

This is Part 2 of a three-part series. Part 1 appeared in O&GJ, June 20. The third part will appear soon. This series is adapted from a paper presented at the 1960 spring meeting of API Division of Production's Southern District, San Antonio.

However, this need not reduce bottom-hole pressure and cause formation fluid to flow into the hole.

Bottom-hole pressure is the sum of the pressure confining the gas and the hydrostatic head of the mud below the gas. If not allowed to expand, the gas will be confined by a pressure equal to the formation pressure. Therefore, as it moves up the hole, the bottom-hole pressure increases by the pressure exerted by the mud below the gas. As the gas approaches the surface, the actual bottom-hole pressure can become approximately double the formation pressure.

Thus, if the gas is not allowed to expand, the formation is almost certain to break down. Loss of circulation follows.

Though the formation is more likely to break down, it is possible for annulus pressure to exceed the burst strength of the casing.

Calculate in drill pipe. Since gas must be allowed to expand as it rises in the hole, it would be quite difficult to calculate conditions in the annulus—too difficult, in fact, to be done at the time a blowout threatens. It is possible to calculate conditions by considering the circulating system as a U-tube. That is, the sum of pressures in the drill pipe must be equal to the sum of pressures in the annulus; and the sum of pressures in either case is equal to bottom-hole pressure.

As long as circulation is not reversed, mud in the drill pipe cannot be cut by formation fluid and it is always quite simple to calculate conditions in the drill pipe. Mud weight needed to kill the well is figured with Equation 1 given later. This equation says that the sum of hydrostatic pressure of the mud plus drill-pipe pressure is equal the hydrostatic pressure of the mud needed to kill the well. This allows no overbalance of mud pressure over formation pressure. So, 0.2 to 0.5 lb. per gal. must be added to the mud weight calculated by this method.

If a drill-pipe float is being used, the pressure required to open the float should be used as the drill-pipe pressure.

When the well is circulated, drill-pipe pressure increases as a result of friction in the drill pipe. Pressure loss in the annulus while circulating is quite small and may be neglected. Drill-pipe pressure drop is calculated from the standard hydraulics tables.

As circulation continues and gas in the annulus expands, there will necessarily be a change in annulus pressure. But, if circulation rate and drill-pipe

pressure are constant, there will be no change in bottom-hole pressure. There may be a gain in volume. If it is caught soon enough when the drill is closed in, no pressure will show on the drill-pipe pressure gage. This indicates that P_f is only slightly greater than P_m and, since mud gages seldom show pressure less than 100 psi., the P_{dp} is not great enough to be read. Should this occur, we can assume that mud weight need be increased no more than 0.1 or 0.2 lb. per gal. However, if any mud is gained while circulating, regardless of the increase in mud density required, the well must be put on a choke and handled as previously described.

Ten Steps to Kill Blowouts

The procedure given here is not restricted to kicks that occur while drilling. It also applies to any condition when foreign fluid is entering the well.

Do these things to kill a threatened blowout:

1. When it is found a blowout threatens, stop the pumps immediately.

2. Read drill-pipe and annulus gage pressures (P_{dp}, P_a). Note the increase in pit volume (V) **as soon** as the well is shut in.

3. Open the well on a choke. Then resume pumping as step 2 is done. Adjust choke opening and pumping rate quickly to give a choke pressure approximately 200 psi. in excess of the initial closed-in annular gage pressure (P_a).

4. Immediately upon establishing the desired choke pressure, note the pumping rate (strokes per minute). Hold this **constant** until the well is circulated free of foreign fluids. The initial drill-pipe gage pressure (P_t) should also be noted.

5. Regardless of the readings on the annulus-pressure gage, open or close the choke as required to hold drill-pipe pressure at the readings given hereafter until the well is free of foreign fluid and the heavier mud has reached the surface. You need not raise mud weight until after uncut mud reaches the surface. If you don't raise it, hold drill-pipe pressure constant at the value P_t. However, immediately after uncut mud returns, weight should be increased; this makes it necessary to correct P_t downward as average density in the drill pipe changes.

6. As soon as possible, calculate the mud weight needed to kill the well by Formula 1. Figure circulating pressure, P_c, by Formula 2.

7. Use Formula 3 to calculate drill-pipe pressure to be used at various mud densities in the drill pipe. This reading is always obtained by varying the annulus (choke) pressure through changes in the choke opening; circulating rate is held constant at the value established in step 4.

8. Calculate the density of formation fluid in the well at the time it is closed in from Formula 4. This information is a guide in killing the well, as explained later. However, the density figured will be somewhat in error if the mud in the pit is badly cut with gas.

9. Calculate the capacity of the annulus, steady rate of pumping, circulation time from bottom, and complete circulation time. From these, you can figure the time for return of uncut and weighted mud.

When the required high-density mud reaches the surface, choke pressure will automatically have fallen to near zero. The well can be completely opened, circulation stopped, and the well checked to see that it is dead. The method applies equally to salt-water and gas flows, although the changes in choke pressure will be entirely different.

10. As the well is being killed, you may want to check the pressures being used, the final mud density necessary, or the weight of the foreign fluid. Do this by simply closing in the well and repeating the steps from 1 on.

In the foregoing method, we cannot overemphasize the importance of early detection of flow of formation fluid into the well. Further, we recommend reasonable speed without excessive haste in closing the well in, making required gage readings, and putting the well on choke.

Pipe pressure, not annulus. Annulus pressure is controlled only by volume and pressure of the formation fluid entering the well. Pressure of formation fluid cannot be controlled, but early detection of a flow will help keep annulus pressure to a minimum. This method gives the lowest possible pressures required to kill the well. Should the choke at any time be opened beyond the size determined above, more formation fluid will flow into the well and, eventually, higher pressure will be required to kill the well.

It is imperative that the annulus pressure be allowed to seek its own level and that control be placed only on the drill-pipe pressure. Although changes in choke size affect both annulus and drill-pipe pressures, bottom-hole pressure must be regulated by the drill-pipe pressure. Should the annulus pressure be allowed to fall, or its maximum value be limited because of fear of formation breakdown or casing rupture, the result will be the influx of further fluid which may in turn increase the pressure required to kill the well.

If this method is applied properly and annulus pressure still approaches casing burst pressure, the only hope to control the well would be to flow it as hard as possible to draw down reservoir pressure, or perhaps cause the hole to bridge.

Even if the method is used as specified but annulus pressure is high enough, there is no way to prevent breakdown of the formation. The only thing that can be done is to be aware that such a breakdown may occur and be prepared to prevent the drill pipe's sticking.

Required Calculations

Mud density required to kill the well:

$$W = \frac{P_{dp}}{0.052\ D} + W_1 \qquad (1)$$

Initial circulation pressure:

$$P_c = P_t - P_{dp} \qquad (2)$$

Total circulating pressure necessary as mud density in pipe is increased:

$$P_t = P_c \frac{W_2}{W_1} + P_{dp}\left(\frac{W_r - W_2}{W_r - W_1}\right) \qquad (3)$$

Density of foreign fluid:

$$W_f = W_1 - C_a/.052V\ (P_a - P_{dp})$$
$$= W_1 - K/V\ (p_a - P_{dp}) \qquad (4)$$

Here are equation symbols used in this article

BHP is bottom-hole pressure, psi.
C_a is capacity of annulus, bbl. per ft.
D is depth of drill pipe, ft.
HP_{ma} is hydrostatic pressure of uncut mud in annulus, psi.
HP_{mdp} is hydrostatic pressure of uncut mud in drill pipe, psi.
HP_f is hydrostatic pressure of foreign fluid in annulus, psi.
P_a is annulus surface pressure, psi.
P_c is pressure required to circulate, psi.
P_{ca} is pressure required to circulate annulus, psi.
P_{cdp} is pressure required to circulate drill pipe, psi.
P_{dp} is closed-in drill-pipe top-hole pressure, psi.
P_f is formation pressure, psi.
P_t is Drill-pipe pressure-gage reading when constant circulating rate is established at choke-pressure P_a, psi.
V is pit-volume increase, bbl.
W_1 is initial mud density, lb per gal.
W_2 is average mud density other than W_1, lb. per gal.
W_f is density of foreign fluid in annulus, lb. per gal.
W_r is mud density required to kill well, lb. per gal.
K is $C_a/0.052$.

where:

K = 0.575 for 3½-in. drill pipe, 6-in. hole
0.62 for 3½-in. drill pipe, 6¾-in. hole
0.7 for 2⅞-in. drill pipe, 6¾-in. hole
1.20 for 3½-in. drill pipe, 8¾-in. hole
1.05 for 4½-in. drill pipe, 8¾-in. hole
1.40 for 4½-in. drill pipe, 9⅞-in. hole
1.31 for 5-in. drill pipe, 9⅞-in. hole
2.34 for 5-in. drill pipe, 12¼-in. hole
2.6 for 4½-in. drill pipe, 12½-in. hole
0.9 for 5-in. drill pipe, 8⅝-in. hole

Deriviation Formulas and Basis of Method

1. Justification for step 3. At the time the well is closed in there is no flow in the annulus. Therefore:

$$P_f = HP_{ma} + HP_f + P_a$$

If circulation is resumed instantaneously at a choke pressure equal to P_a, bottom-hole pressure (BHP) will be:

$$BHP = HP_{ma} + HP_f + P_a + P_{ca}$$
$$= P_f + P_{ca}$$

where: P_{ca} is the annular circulation drop.

(Note: This ignores a compressing effect of annular circulating pressure on the gas in the annulus, but this is relatively small and acts as an added safety factor over formation pressure.)

Therefore, bottom-hole pressure is greater than P_f by the amount of P_{ca} and no entry of formation fluids is possible. But P_{ca} is usually less than 100 psi. and is not readable on a standard mud gage. Since a constant circulation rate is desirable and P_{ca} is not readable, P_t remains constant regardless of change in flow rate in the annulus. Therefore, some readable back pressure (100-200 psi.) is added as soon as circulation is established to act as a safety factor. This back pressure will be lost before any fluid can enter from the formation.

Care is needed to prevent back pressure building up too high, particularly in wells that have only surface casing set. A 300-psi. back pressure at a 2,000-ft. casing seat would be equivalent to an increase of 2.8 lb. per gal. in mud weight. This could easily lead to loss of circulation.

Choke pressure calculated here is correct only at the time circulation is begun since gas expansion and consequent loss of mud from the hole may require a different P_a.

2. Justification for steps 4 and 5. When circulation is established immediately against choke pressure P_a, the bottom-hole pressure, as already shown in 1, is:

$$BHP = HP_{ma} + HP_f + P_{ca} + P_a$$
$$= P_f + P_{ca}$$
(annulus condition)

The only part of the drill-pipe circulating pressure existing beyond the bit is P_{ca}. Therefore, from 1 the bottom-hole pressure is also:

$$BHP = HP_{mdp} + P_t - P_{cdp}$$
$$= P_f + P_{ca}$$
(drill-pipe condition)

Either of these formulas is correct and, if the various factors could be adequately followed, either would be satisfactory to use in assuring that bottom-hole pressure is correct while killing a well. However, the factors in the formula which are based on annulas conditions are difficult, if not impossible, to use.

It is necessary for the gas to expand as it circulates up the annulus. This decreases the amount of mud in the annulus. As a result, HP_{ma} and HP_f vary in a manner that cannot be followed and they must be compensated by an unknown change in P_a. A further complication is the rising column of uncut mud as the well is killed.

Drill-pipe conditions are easier to follow. Hydrostatic pressure of the mud is unchanged unless mud density changes. When circulation is established against P_a, P_{dp} is overcome and is a part of the total pressure on the drill-pipe gage. In fact, at the constant pumping rate established:

$$P_t = P_{dp} + P_c$$

P_{dp} is thus applied when circulation starts. If circulating rate is held constant as prescribed and P_t is held constant by varying the annulus choke, then P_c and P_{dp} are constant. This assures bottom-hole pressure is sufficient.

P_{ca} is a part of P_c and varies some even if P_t is held constant. We have already shown P_{ca} is a safety margin and its variation can only affect the margin over P_f and is, therefore, permissable. The well could be circulated free of formation fluids safely without increasing mud weight. However, any corrections necessary in P_t as mud density in the drill pipe changes are easily calculated.

3. Justification for step 6 and mud density required to kill well. At the time the well is closed in there is no flow. Therefore:

$$P_f = HP_{mdp} + P_{dp}$$
$$= 0.052\ W_1D + P_{dp}$$

and this simplifies to:

$$W_r = P_{dp}/0.052\ D + W_1$$

4. Justification for step 7. Only the density of the mud in the drill pipe changes during the building of mud density. Thus, circulating pressure through the pipe, P_c, changes. A corresponding change must be made in P_t if it is to be held correct and if correct bottom-hole pressure is to be held.

With the circulating rate held constant, P_c changes as the average density of mud in the drill pipe changes, or:

$$P_{c2} = P_{c1}\ (W_2)/(W_1)$$

P_{dp} should be reduced as mud density in the pipe increases since the mud-density increase compensates for required surface pressure. The change in P_{dp} depends on the increase in density necessarily made at any instant:

$$P_{dp2} = P_{dp1}\ (W_r - W_2)/(W_r - W_1)$$

Circulating pressure is composed of P_c and P_{dp}; therefore, the correct circulating pressure P at any higher average drill-pipe mud weight is:

$$P = P_c\ (W_2/W_1)$$
$$+ P_{dp}\ [(W_r - W_2)/(W_r - W_1)]$$

5. Derivation of formula 4. From 1 and 2 the following is true at the time the well is closed in:

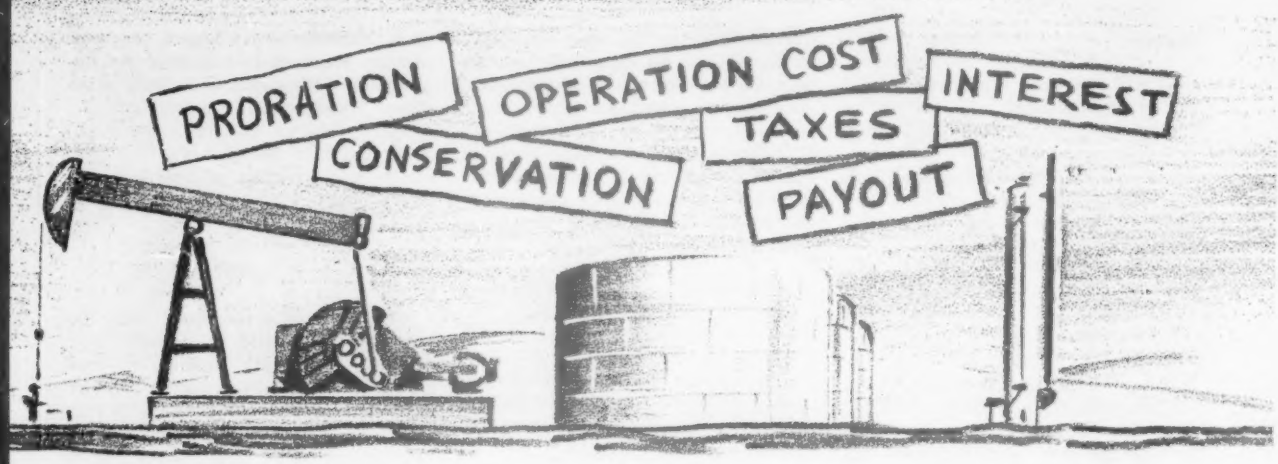
$$HP_{mdp} + P_{dp} = HP_{ma} + HP_f + P_a$$

Pressure of any column of fluid is $P = 0.052WD$. The volume of formation fluid in the annulus is equal to the increase in mud-pit volume, V. The feet of foreign fluid in the annulus is V/C_a, where C_a is the capacity of the annulus in barrels per foot. The feet of mud remaining in the annulus is $D - (V/C_a)$. Thus, expressing the pressure in psi:

$$0.052\ W_1D + P_{dp}$$
$$= 0.052\ W_1\ [D - (V/C_a)]$$
$$+ 0.052\ W_f\ (V/C_a) + P_a$$

This simplifies to:

$$W_f = W_1 - [(P_a - P_{dp})/(0.052V)]\ C_a$$
$$= W_1 - (P_p - P_{dp})\ (K/V)$$



PART 2

"As long as we are living in an economy with as wide fluctuations as are to be expected for the future, and as long as the oil-production operations are so clearly affected by supply-demand considerations and by state and federal actions, careful analysis of the economics of valuation theory is an integral part of the reserve valuation."

Don't forget the role of economics in

reserve valuations

BY E. A. HARTSOOK
Production Economist
Standard Oil of California

IT MAY BE appropriate to look for a moment at the economics of market-demand proration and its effect on the evaluation calculation. Then, in turn, we will come to appraisal of the impact of existing conservation laws on these determinations.

Just as price fluctuations and interest-rate decisions can cause wide variation in valuation results, the workings of oil supply and demand as they reflect themselves in the decisions of state agencies in proration rules are extremely important to an adequate reserve evaluation. True, supply-demand effects are not easy to anticipate and certainly they cannot be applied as precisely as can physical reservoir data. This does not in any sense, however, warrant overemphasis on the technical, engineering phases—just because they are somewhat more finite and therefore easier to deal with—at the expense of other significant elements.

Going back to the first part of this article, let us look again at the illustration pool ALPHA in Fig. 1. Production was determined for this curve, let us say, on pure engineering grounds of good oil-field practice. Now, suppose that because of market proration regulations, this production was restricted for only the first 5 years of the production curve. Suppose this restriction amounted to 50% and the production curve was raised over the last 15 years to make up for the reductions in the first 5 years.

The effect of this change is to give a new 5% value to the reserve of $1,570,000 as compared to the earlier determination; or a new 20% value of $630,000 compared to $920,000. Clearly, the change is substantial. What in the first instance was a sound financial prospect has suddenly deteriorated unless the finances of the transaction itself took this into consideration.

Investment and the Conservation Laws

Now, to this, we should add another seriously complicating factor. As much recent discussion within the industry has indicated, the actual method of determining allocations has a real bearing here too.

Today's conservation laws put an unjustified but definite premium on number of wells in allocating production. In Louisiana, a property receives its allocation strictly in relation to number of wells and depth. In Texas there is a slight acreage credit

In the last issue...

In Part 1 of this article, last week, we discussed the importance of economic elements to the accuracy and adequacy of reserve valuations—whether the valuation is made to establish a price base or to pinpoint development strategy.

We talked about price and the tricks it can play on the unwary analyst. We looked at some of the pitfalls lurking behind the precise techniques of investment rates of return and payout calculations, and we discussed some of the questions that must be answered in deciding on interest rates for analytical purposes.

but, essentially, the allocation again relates to number of wells.

Because of this emphasis in the conservation laws, the analyst making a valuation calculation can no longer ask himself simply what sound engineering development is indicated. In order to maximize the allocation to the property (and thus its anticipated value) he must add additional investment in wells. That this is uneconomic, wasteful, and a profound shame in its effect on costs and ability to compete is obvious. That it has a profound bearing on valuation results is not always quite as obvious. The result of these incentives to unnecessary drilling, however, is to make marked alterations in both the production curves and the investment calculations. If these considerations are ignored in setting the ground rules for the evaluation itself, the errors generated can be tragic when it later comes to fitting result to original plans.

Because of the implications of conservation practices acting through production allocations and drilling incentives, the underlying problem of predicting both the long and short-term demand situation becomes tremendously important. It is also, of course, an essential element in making determinations about prices to be used in the valuation situation.

Preparatory Analysis

It should be evident that this market demand we are discussing is a very specific thing in a given problem. It is not just the over-all estimate of market for oil nationwide. It is a unique question in a given evaluation.

What is the anticipated market in the geographical area involved after consideration of transportation and refining complexes? What is the market for the particular quality of oil involved considering gravity, impurities, chemical makeup, etc.? Who will prospective purchasers be and what are their short and long-term prospects?

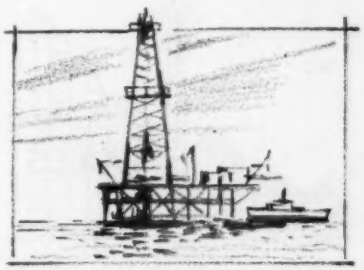
No valuation, whatever its purpose, can really be considered complete or as fully informed and helpful as possible until these demand problems are thought out. It is far beyond the scope of this article to deal with the many reasonable techniques of economic analysis that may be applied in reaching solutions. We can, however, indicate the general approach and at least some limits to the problem.

Look ahead. The place to start is usually with a concept of energy demand (microeconomic as compared to macroeconomic techniques), and in particular, the role of petroleum in national and local markets of the future.

Surprisingly often, economic thinking when applied to valuation work tends to look only at the current situation and fails to be sufficiently sophisticated about events to come. This is perfectly understandable, of course. We all tend to be most influenced by immediate events around us. Still, knowledge of the future usually holds the real key to success. Investment policies, influenced largely by immediate events, can lead to company or individual policies that are simply expedient and fail to take advantage of at least major foreseeable events.

We do not have to look far to see examples of this. Companies and individuals who—following World War II—failed to anticipate the energy demands of the fifties and sixties find themselves caught short in reserve position and value today because of the failure to invest then. Now they find themselves involved in a dizzy effort to keep up when costs are high and oil is plentiful. There is plenty to be bought but the important, diversified, reserve position is now difficult to obtain economically.

Looking further, we have the current intriguing situation in which the cost of finding oil in some areas is considerably greater than the price the oil will bring in today's markets. And we see major investments being made in expensive, remote, and often politically unstable locations. We see the drilling of marginal wells in essentially developed fields where disposition of production is already a problem. We see drilling forced to a considerable extent by the pressure of conservation-law allocation based on total number of wells.



". . . we have the intriguing situation in which the cost of finding oil in some areas is considerably greater than the price the oil will bring in today's markets."

How much of all this is really sensible, sound investment? And how much of it is thought out relative to the total energy picture and the specific problems and plans of the individual investor? In all likelihood, far too little. It is simply easier to be carried along by the stream of things, and by the influence of what others are doing.

The base, then, of a good, useful valuation should be in the feeling for trends and future problems and opportunities in the energy business, that comes with evaluation of probable energy developments over the coming 10-20 years at least. True, it won't be perfect, but it will give direction and purpose to the results obtained.

This demand review should certainly include a fairly thorough study of the history of the energy industry and the factors contributing to the growth patterns of the major segments of it. It should go on from this to analyze developments in the various energy-consuming segments of the economy and appraise their effect on quantities and types of energy to be used tomorrow. Trend analysis is really not too helpful here, either. The best understanding in an economy where technology is altering patterns so rapidly can only come through cumulative analysis. (Theories of descriptive analysis and macroeconomics are of value here.)

Government Factors

Then, certainly, the demand study must include appraisal of such major factors as government policy and new potential sources of energy. The role of the federal Government in conducting trade policy (and particularly import policy in the energy field) is tremendously significant.

As we have mentioned earlier, state policies of conservation and changes that may (and probably should) be made in them will be important. And the effect of new energy sources such as major secondary-recovery additions in oil operations and developments in tar sands and oil shales will certainly be felt reasonably soon. Further along, but beginning to have bearing on long-range thinking, are atomic and other more esoteric resources.

All of these factors contribute to demand concepts that are sound. And, in turn, they contribute to economic factors used in the reserve valuation and in the investment policies behind that valuation. It should be evident by now that it is these policies and their application in the form of price, production, and interest-rate assumptions that will largely govern the effectiveness of the valuation itself.

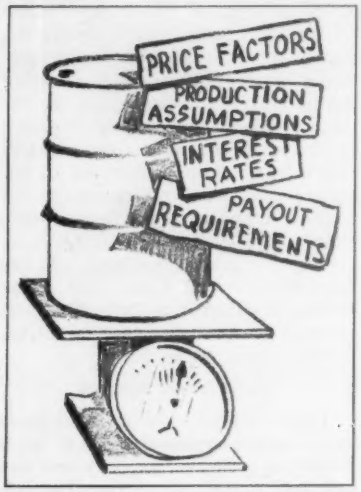
What Does the Investor Want?

Following careful review of demand concepts, we reach the second specific stage of economic review to determine proper valuation policies. This involves coming to grips with the specific investor's problems

and opportunities as reflected against the background of demand thinking.

What does the investor want? Is his prime interest short-range or long-range? What kind of a business and investment strategy is he following? Where does he want to be, and when? What special resources and talents can he bring to bear? What kind of markets and what geographic areas of activity reflect his purpose?

These are the specifics that allow the analyst to make his evaluation meaningful to a particular situation.



"Price factors, production assumptions, interest rates, and payout requirement relate to a specific plan of intent and instead of being picked "by-guess-and-by-golly" the choices have intellectual substance."

Again going back to the first part of this article, we can now see at least the guidelines that will help answer our earlier questions. Price factors, production assumptions, interest rates, and payout requirements begin to relate to a specific plan of intent and instead of being picked "by-guess-and-by-golly" the choices have intellectual substance.

Cost

There are two other principal economic factors that require careful evaluation even though we do not have sufficient space here to discuss them in detail.

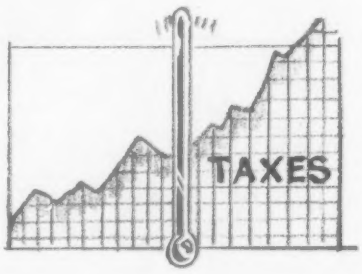
The first, of course, is cost itself. While costs do not, generally speaking, have the bearing on valuation results and decisions that the preceding factors do, they are clearly significant. Normal practice involves making basic, sound oil-field-practice calculations as to investment cost, and basing operating-cost estimates on experience factors in similar operations. Usually this is adequate as long as the effect of conservation laws is considered.

But in valuations involving secondary recovery and reasonably long-range objectives, cost patterns themselves should be considered. Depending on the nature of the price values used, some reflection of changing dollar value can be important. If these values have been a factor in making price decisions, there is a very real need for incorporating dollar-change effect in the cost side in order to avoid exaggeration of results. And, since in terms of price-demand analysis it may be helpful to consider inflation's effect, industry-by-industry, the cost-price values finally used will probably be most thorough if they include value changes.

Taxes

Finally, we surely cannot overlook our old friend, the tax factor—both income tax and property tax (and, of course, foreign-revenue structures if overseas properties are involved).

Taking property tax first, in most cases it, like operating costs, can be arrived at fairly readily by a look at immediately surrounding areas and operating experience. On the other hand, we are beginning to see appreciable changes in this tax factor in communities that are hardpressed to keep up with growing budgets, so it is well to at least question the applicability of normal experience factors.



"We surely cannot overlook our old friend, the tax factor—both income tax and property tax (and, of course, foreign-revenue structures if overseas properties are involved)."

Income tax is an entirely separate problem. Much has been written on it and its importance is widely recognized, as compared to some of the other economic factors we have been discussing. There should be little argument over the need for careful thought here but this should not stop at appraising the best way to set up the transaction to minimize taxes.

After the usual considerations of form are applied, the valuation analyst is still faced with the problem of evaluating the future. Is the tax structure likely to remain the same? Are there changes in rates on the horizon? How will the answers to these questions affect the specific valuation being developed? Will the answers influence the manner in which I develop the reserve—or produce it?

Again, obviously, the answers will not be perfect. But the questions will not go away just by being ignored. A great deal of money may hang on the answers being at least directionally correct and final valuation results should be used only after they are evaluated thoughtfully.

Conclusion

The variety and depth of many of the questions that we have raised here indicate that the kind of approach to valuation analysis that adequately covers the economic factors involved is a complex, demanding proposition. It seems evident that each individual investor is not going to be able to do all that is required. At the same time, it will certainly pay even the small investor to think through these questions as well as he can. The larger industrial companies, financing organizations, and the like can apply their existing staff analyst groups to these tasks. In addition to this, consultants that specialize in valuation work should be equipped to give advice and knowledgeable assistance.

The reader may ask, "Is all of this really part of a reserve valuation—or in reality does it involve primarily management decision making?"

Actually, of course, there is an element of both in a good valuation calculation. It must be recognized, however, that any valuation that in the final result presents either dollar values in one form or another, or involves predictions of production and cost for the future, **must** consider the economic factors. There is no way to avoid it or to limit even the technical phase of the valuation strictly to engineering and geological considerations.

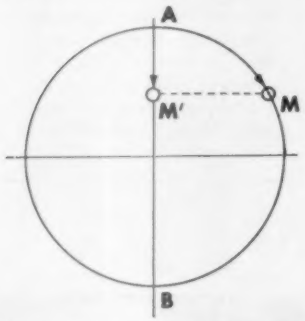
As long as we are living in an economy with as wide fluctuations as are to be expected for the future, and as long as the oil-production operations are so clearly affected by supply-demand considerations and by state and federal actions, careful analysis of the economics of valuation theory an integral part of the reserve valuation. In order to do a thorough and really responsible job, the valuation analyst must be in a position to advise his principal fully, from both a technical and an economic standpoint.

A look at the pumping motion

BY JOSEPH ZABA

IN ANALYZING a sucker-rod pumping system certain assumptions are usually made to simplify the considerations involved. One of them is that the motion is simple harmonic, when, in fact, it is only approximately simple harmonic.

Fig. 1 shows true simple harmonic



M' DESCRIBES true simple harmonic motion if M is rotating at constant angular velocity. Fig. 1.

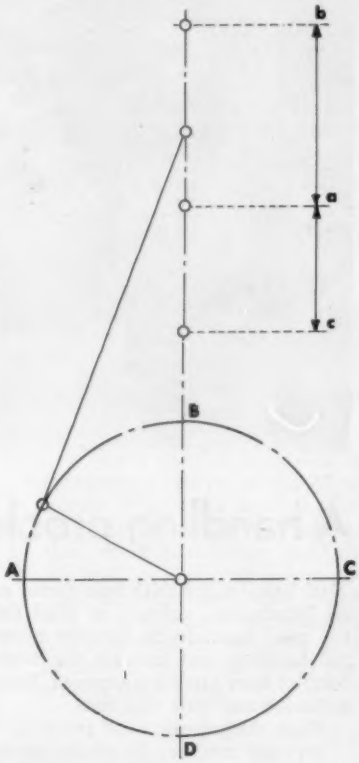
motion. If a point M is rotating with a constant angular velocity along the circumference of a circle with diameter A-B, then the movement of the projection M' of point M on the diameter A-B is described as a simple harmonic motion. This is a rectilinear, vibratory motion with acceleration proportional to and opposite in sign to displacement, that is, to the change of position in relation to a fixed point of reference.

In a conventional pumping-unit assembly the rotating motion of the crank imparts to the polished rod a vibratory motion which is not true harmonic motion for a number of reasons. First, the angular velocity of the crank is seldom if ever constant. Second, the angularity of the pitman affects the character of the motion. Third, the geometry of the unit has some effect on the velocity involved.

Polished-rod motion. The effect of the angularity of the pitman has been illustrated by comparing the motion of the pitman and the pitman bearing assembly to that of the connecting rod and the crosshead of a reciprocating engine.[1,2] This analogy is valid even though the crosshead moves in a straight line while the pitman bearing moves along an arc with saddle bearing as the center of the arc.

Referring to Fig. 2 when the crank describes the arc from A to B to C, the crosshead moves over the distance from a to b and back to a. This distance is longer than the distance from a to c and back to a which corresponds to the travel of the crank from C to D to A. Reason is that, as far as crosshead travel is concerned the horizontal and vertical components of the travel of the crank are additive in the upper portions of the crank's travel and are subtractive in the lower portions of the travel.

As the length of the connecting rod increases in relation to the length of the crank there is a decrease in the difference between the distances over which the crosshead travels for the upper and lower parts of the crank rotation. For an infinitely long connecting rod, or pitman, the two distances would be equal.



CRANK MOTION shown here is not simple harmonic motion. Fig. 2.

These facts can now be correlated with the questions of velocity and acceleration. Since the angular velocity of the crank is assumed to be constant, and the distance traveled by the crosshead from a to b (Fig. 2) and return is longer than from a to c and return the crosshead velocity and acceleration are higher in the upper than in the lower portions of the crosshead travel.

To apply these considerations to the pumping motion, since the pitman bearing travels in the direction opposite to that of the polished rod, the velocity and acceleration of the polished rod are higher from the midstroke to the bottom of the stroke and return than from the midstroke to the top of the stroke and return.

These differences in velocity and acceleration decrease with the increase of the ratio of the length of the pitman to the length of the crank.

The fact that the polished rod travels faster during the lower than during the upper portion of its stroke is true in case of the conventional pumping units in which the crank and the pitman are on the side of the samson post opposite to that of the well.

In case of air-balanced pumping units, or weight-balanced units with geometrical arrangement similar to that of air-balanced units, the crank and the pitman are on the well side of the samson post. The pitman bearing travels in the same direction as the polished rod.

Therefore, the velocity and the acceleration are higher in the upper than in the lower portion of the polished-rod travel.

Analytical studies performed a number of years ago[3] show that the velocities and acceleration of the polished rod are affected by (1) the relative positions of the saddle and pitman bearings, (2) the center of rotation of the crank and pitman bearing with the beam horizontal, and (3) the relative lengths of different components of the unit.

Plunger motion. The polished-rod

motion transferred through the sucker rods to the plunger results in the pumping cycle shown in Fig. 3. By reducing a number of different parts of a sucker-rod pump to a schematic arrangement, it is seen that there are four basic parts: working barrel, plunger, and traveling and standing valves.

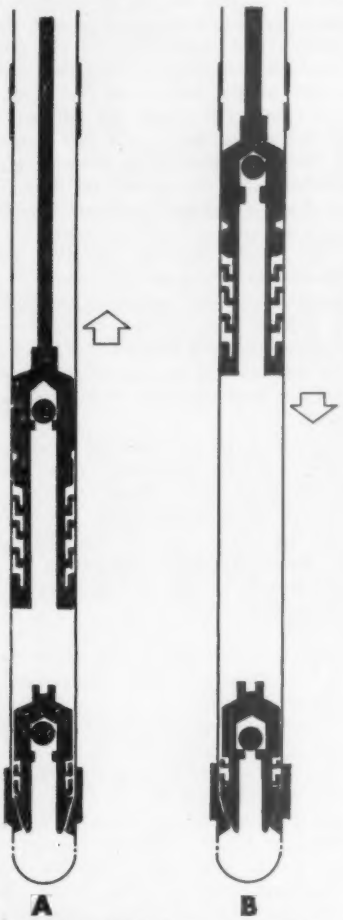
With the pump submerged in the well fluid the upward motion of the plunger at the beginning of the upstroke, Fig. 3A, results in closing of the traveling valve because of the weight of the fluid in the tubing above the plunger. The full weight of the fluid is taken up by the rods. At the same time, because of the upward motion of the plunger a decrease in pressure is created within the pump's barrel and the fluid outside of the tubing enters the pump through the opened standing valve.

When the motion of the plunger is reversed at top of the stroke, Fig. 3B, the traveling valve opens, the standing valve closes. The load of fluid is placed on the tubing. The plunger travels through the fluid to the point of beginning of the cycle.

The pumping cycle as described here is an oversimplification of conditions existing in actual pumping operations. It neglects the effects of incomplete filling of the pump's barrel during the upstroke, of presence of gas within the pump, and of actions resulting from behavior of different parts of the pumping mechanism.

Its purpose is to point out the transfer of fluid load from rods to tubing and back to the rod during each pumping cycle which is one of the factors affecting the plunger motion. Rods and tubing are elastic and their length changes with imposition and release of loads.

Certain motion of the polished rod is required for instance at the beginning of the upstroke, before the motion of the plunger in relation to the barrel can start due to the stretch of rods with imposition of loads. This transfer of loads and several other factors, to be discussed later in detail, make the motion of the plunger quite complex.



ON THE UPSTROKE, A, the weight of the fluid is picked up by the sucker rods. On the downstroke, B, fluid weight is transferred to tubing. Fig. 3.

References

1. W. C. Shutts and Bowman Thomas, "Efficient Operation of Pumping Rigs": Proceedings first midyear meeting, API Division of Production, Production Bulletin 207, 193.
2. Wm. G. Corey, "The Air Balanced Pumping Unit": Paper presented at the sixth annual mechanical-petroleum engineering conference ASME, Tulsa, September 1951.
3. Kenneth N. Mills and E. A. Olsovsky, "Effect of Design and Direction of Rotation on Peak Torque of Pumping Unit": Petroleum Engineer, August 1939.

Pipeliners—

Don't miss

Journal Pipeline Cost Report No. 3, starting on page 99. It's 16 pages full of vital cost data covering compressor-station operations by type of drive, and pipeline and compressor-station construction costs, past, present, and future.

A handling problem—and its solution

THE ENGINEERING field forces at the Norco, La., refinery of Shell Oil Co. used ingenuity to simplify material handling and increase the flexibility of their present equipment. Here is the job and what was done.

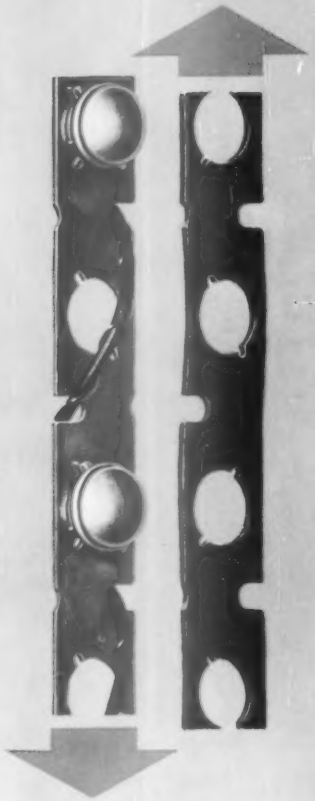
Work assignment: Load catalyst.

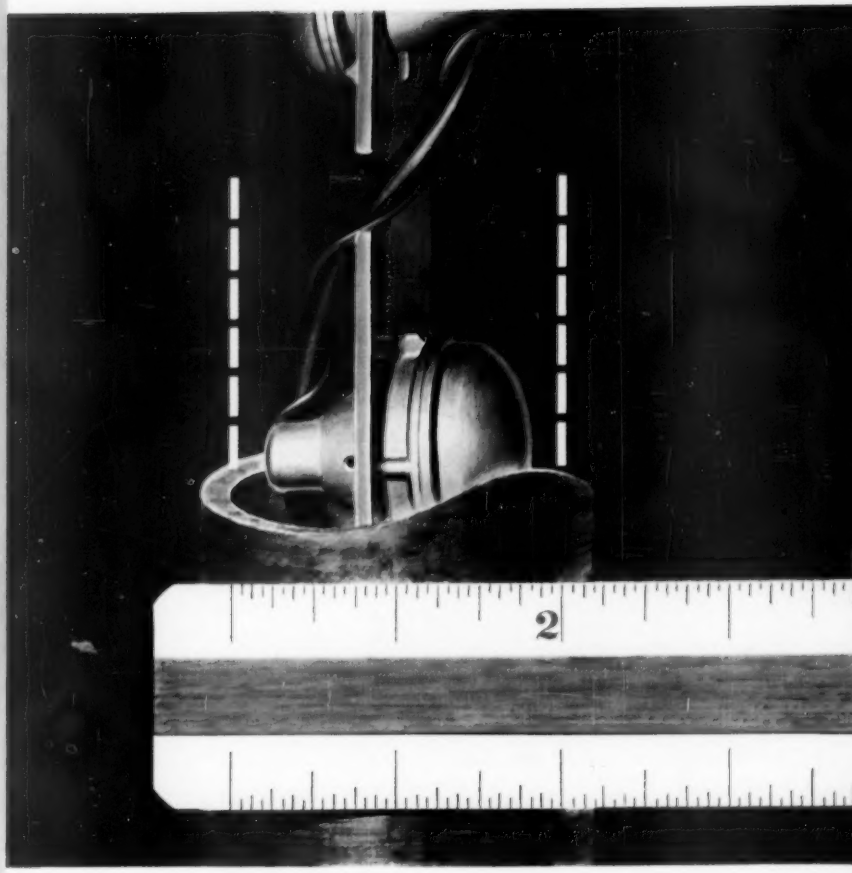
Previous method: Manually dump barrels of catalyst into a hopper. Hoist the filled hopper to the top of the reactor with a crane, and dump.

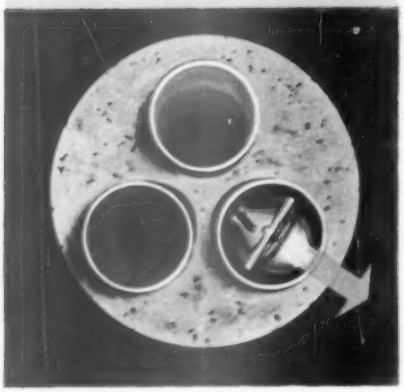
Problem: Cut loading time.

Solution: Mechanically handle four drums at once (photo) by adapting a Cascade barrel-gripper to the boom of the refinery's Gradall.

Result: The job is simpler, less down time and manpower required now, and a piece of equipment gains added flexibility.







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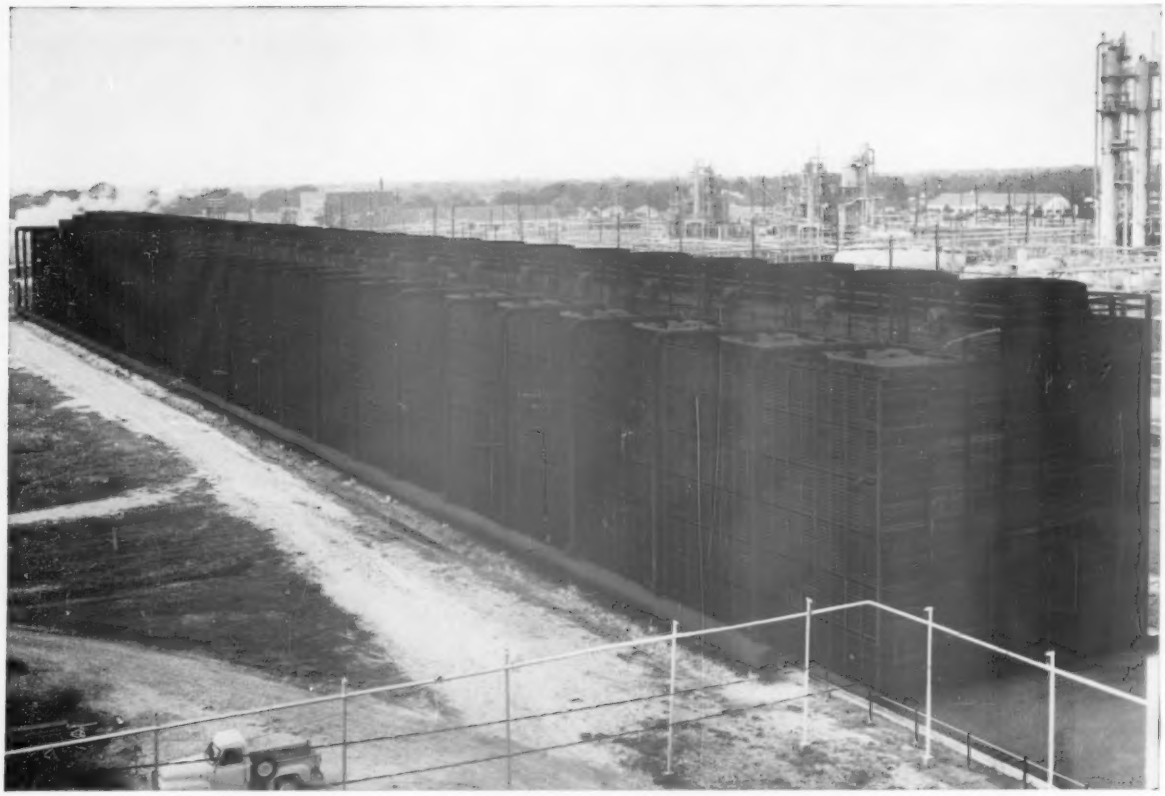

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Faced with shutdown of process units because of a damaged, partially inoperative cooling tower, a large Gulf Coast oil refiner called upon HUDSON for emergency supply of new cooling capacity. Despite necessity for modification of HUDSON standard design to conform to existing foundation, and though working under adverse condition of stepwise removal and replacement of partially operating old tower, more than 30 percent of the new HUDSON tower was operating in less than five weeks. The promised time schedule was met, the crisis averted, and guaranteed cooling performance exceeded.

Performance of such special services with speed, ability and integrity is a measure of the quality of HUDSON service — whether in repairing or replacing an operating cooling tower, or in designing and supplying a complete integrated system with balanced use of water and direct air for cooling all process streams.

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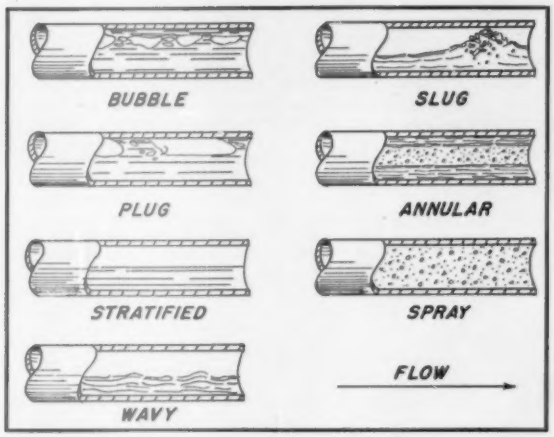


FLOW PATTERNS in multiphase flow are classified in these seven ways. Pressure drops can be two to ten times greater than for single-phase flow.

BY H. C. BOZEMAN
Gulf Coast Refining Editor

These flow patterns create big pressure drops. The AGA-API is busy looking for answers to some knotty . . .

Multiphase-flow problems

MOST ENGINEERS dealing with multiphase flow for the first time are astonished to learn that pressure drops are often 10 times greater than single-phase flow.

Further, they find the accuracy of pressure-drop calculations using present design equations varies widely: for sizes up to 6 in. in diameter, ±30% difference in pressure drop and for sizes 14 to 18 in. in diameter, ±75%. So, to insure design capacity it's necessary to install pipe one or two sizes larger than calculated.

To reduce the error to ±20% or less requires a strong research effort, and in 1958 AGA and API formed the joint multiphase-flow committee composed of members experienced in multiphase flow.

The committee will determine multiphase-flow characteristics in pipes of 1-in. diameter and larger, in horizontal, inclined, and vertical positions, and will derive equations for sizing pipe.

Economics. The extra pipe installed to insure design capacity costs the oil and gas industry an estimated $24 million annually, according to the committee.

A breakdown of the cost shows the potential savings available to each branch of the industry:

Better multiphase-flow design could save refineries and gasoline plants about $5.5 million annually through reduced pipe sizes, increased capacity, and reduced maintenance. Gas-gathering line costs could be cut $10 million annually through reduction of pipe size. Costs of offshore gathering lines planned during the next 3 or 4 years could be cut $2 million annually by use of smaller pipe. Production costs could be cut $6.5 million annually by increased use of slim-hole drilling, savings in lifting costs by delay of gas-lift operations, and savings in gas reserves.

Multiphase Flow—What Is It?

The committee is studying flow which has a gas phase and one or more liquid phases flowing together in the same pipe. Multiphase flow occurs in refinery and gasoline-plant processing equipment, pipelines, and producing wells.

Here are some of the characteristics of two-phase, two-component flow:

A gas and liquid mixture flowing together in a pipe tend to separate into two phases. The gas flows 2 to 10 times faster than the liquid and leaves the liquid behind. The liquid is moved along slowly by the drag of the gas on the interface between the phases.

The pipeline is in equilibrium when liquid leaves the pipe as fast as it enters. The liquid phase, at equilibrium, occupies from 30 to 70% of the pipe volume. At these conditions the gas has less volume in which to flow. It blows through the pipe and causes roughness to the liquid surface and violent rising and falling of the liquid.

These actions consume energy, and greatly increase pressure drop over single-phase flow.

The fluid dynamics of multiphase flow are extremely complex. There are seven different flow patterns, each more different from the others than the difference between laminar and turbulent flow in single-phase systems.

Multiphase-flow pipelines are unstable. When changes are made to the pressures or to flow rates, the pipeline readjusts itself gradually and equilibrium may not be reestablished for several days. A two-phase pipeline is both a pipeline and an extremely long storage tank; changes in flow conditions cause the liquid to go into or come out of storage.

The liquid in multiphase pipes passing over hills tends to run back downhill and accumulate in the valleys. Increasing the velocity in the uphill portion of the line reduces the liquid holdup in the valleys and lowers the pressure drop.

Attacking the Problem

The multiphase-flow committee's program is to collect all the test data published and to solicit test data and design methods from companies operating multiphase pipelines.

Then, the data will be correlated, to test new ideas and correct present equations. At the conclusion, a report will be issued giving the design equations for various applications of economic interest to AGA and API members.

Laboratory research since 1930 gradually improved design equations until pressure drop can be estimated to ±30% for pipe up to 6 in. in diameter. Accuracies of ±5% are common now for single-phase systems.

About 4,500 data points from test results are published. In the last 20 years about 200 technical articles on multiphase flow have appeared and some 10 design equations proposed.

The proposed equations were satisfactory for the data on which they were based. However, the committee found no one used all the published data. It also found the published data on large pipelines above 12 in. are insufficient, the fluid dynamics—even in small pipes—is not understood, and bad tests prevent accurate correlation.

A strong research effort is needed to improve design equations. It requires collection of test data from pipelines of larger diameter and a new method of correlation based on a better understanding of fluid dynamics.

The committee has, since formation, collected the published data and data from the members' own companies. The data are being screened this year and those reliable kept in a data bank on IBM cards. When completed, sets of these cards will be available from the AGA and API.

More data are needed and the committee requests oil and gas companies to submit the location, size, and oil-gas ratio of multiphase pipelines that could be tested. Sizes above 12-in. are especially valuable. The committee requests oil and gas companies to submit new multiphase data and design methods already in complete form to Sam J. Cunningham, secretary, Multiphase Flow Committee, American Gas Association, 420 Lexington Avenue, New York 17.

These data will be added to the data bank for testing correlations.

Testing of multiphase pipelines is encouraged by the committee. A test procedure was prepared and published in The Oil and Gas Journal (Nov. 30, 1959, pp. 60-66) under the title "Here's a Suggested Method for Adequate Testing of Multiphase-Flow Pipelines," by Orin Flanigan and others.

Companies testing their multiphase pipelines with the suggested procedure are requested to furnish the committee with the data. It is from these data that accurate design equations should be derived.

BOOKS

Catalysis Series Completed

Volume 7, last in Paul H. Emmett's epoch-making series on CATALYSIS, is now available. This completes the most exhaustive reference source ever published on the physical chemistry of catalysis and catalytic processes.

The 378-page volume includes four chapters on catalytic oxidation, one on hydration-dehydration, and one on cracking catalysts.

The chapter dealing with cracking is devoted to the nature of natural clay and synthetic silica-alumina catalysts for catalytic cracking of gas oil. Chemistry of the solid Xerogels, changes in use, acidity and acid strength, and acidity and activity are treated in some detail.

The study of catalytic hydration and dehydration has not been as extensive as some other fields of catlysis. Production of butadiene from alcohols and possible synthesis of alcohols by the hydration of olefins are creating considerable interest at this time. Current ideas about the mechanisms by which hydration-dehydration catalysts operate are outlined.

Topics included in the discussion of hydrocarbon oxidation are catalytic conversion of benzene. naphthalene, toluene, ethylbenzene, benzyl alcohol, benzaldehyde, o-xylene, polynuclear aromatic hydrocarbons, substituted aromatic hydrocarbons. naphthenes, terpenes, heterocyclic compounds, acetylene, ethylene, propylene and higher olefins, and four-carbon hydrocarbons. Attention is given to effect of hydrocarbon structure on catalytic oxidations, and initiating temperature for catalytic oxidation of hydrocarbons.

The mechanism of catalytic oxidation is examined at some length. This includes a look at electronic properties of exidation catalysts, and correlation of catalyst properties with catalyst performance.

Other topics on oxidation include conversion of ammonia, methane, carbon dioxide, sulfur dioxide, and miscellaneous compounds.

CATALYSIS—Volume 7 is published by Reinhold Publishing Corp., New York, and sells for $13.50. It may be ordered from the Reader Service Department, The Oil and Gas Journal, Box 1260, Tulsa 1, Okla.

RADIATION PYROMETRY AND ITS UNDERLYING PRINCIPLES OF RADIANT HEAT TRANSFER. By Thomas R. Harrison. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 234 pp. $12.

Designed to help the reader analyze and solve the many technical questions concerning the use of radiation pyrometers in a variety of industrial conditions, this comprehensive treatise presents both the theoretical and practical principles of radiation pyrometry.

Material in the first three chapters offers a unified discussion of the laws of emission, absorption, reflection, and transmission of thermal radiation, applicable to the field of radiant heat transfer as well as radiation pyrometry.

The remaining chapters include important descriptions and mathematical analyses of the physical and operating characteristics of radiation pyrometers and the application of emittance corrections. All necessary steps for mathematical deductions are given.

The last chapter lists a number of valuable tables that show radiation pyrometer calibrations, optical characteristics of various substances, some radiation functions, and certain mathematical relationships that find application in radiation pyrometry.

ENGINEERING THERMODYNAMICS. By James B. Jones and George A. Hawkins. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. $8.50. 724 pp.

This is a textbook intended for use in undergraduate engineering courses in thermodynamics. The authors believe that a first course in this subject should give abundant explanations and illustrations of the fundamentals. To this end the explanations in the early part of the book are often exhaustive, and there is a special regard for various points that are known to be stumbling blocks for students. The amount of explanation is decreased as the book progresses and the student gains familiarity with the subject.

There are many completely solved example problems, where statement and solution are clearly distinguished from each other. For some of these, there is a detailed discussion of the reasoning used in obtaining a solution. All the solutions are derived from principles, and not from the extraction of special-case equations. Each chapter ends with a summary as a study aid, and a list of references.

More than 700 problems covering a wide range of difficulty are included, so that the level of the course can be largely established by selection of the problems which are assigned.

MARINE LUBRICATION. By G. H. Clark. Published by Simmons-Boardman Publishing Corp., 30 Church Street, New York 7. 635 pp. $16.

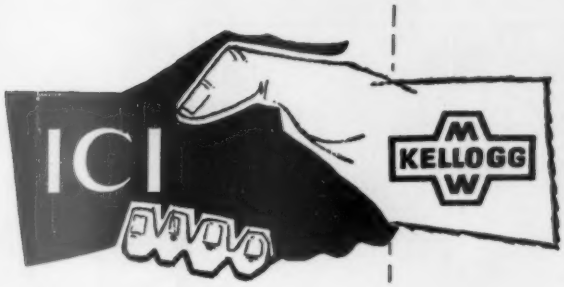
This book covers every aspect of its subject from the fundamentals of lubrication to the lubricating requirements of nuclear-propelled ships.

Although dealing specfically with the marine engineer's plant, the information will be of great value to all land engineers who are concerned in any way with the design, manufacture, installation, running or maintenance of any type of power plant, and its auxiliary machinery, which could be used on a ship.

At no time in engineering history has the subject of lubrication been as important as it is at present. The modern power unit produces higher output from less fuel and operates at higher speeds with reduced size and weight, and the consequent operating conditions impose severe duty on the lubricants.

The problems of using the correct grade of lubricant and applying it in the correct manner are matters which have to be considered during early design of the plant. These problems are studied in this book.

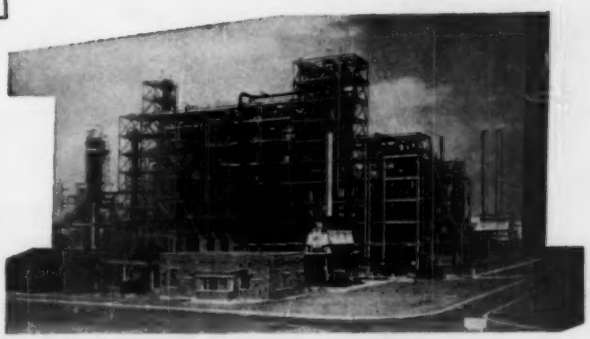
Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.



KELLOGG BUILDS FOR I.C.I. EXPANSION

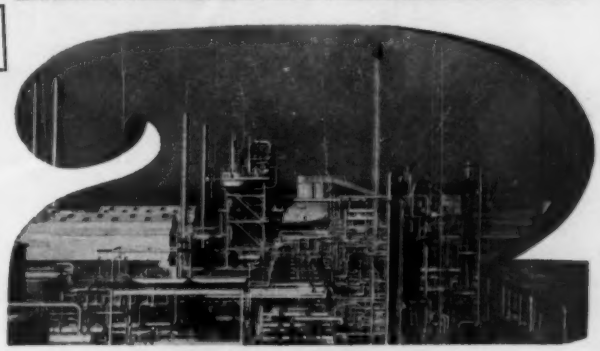
1951

Recent completion of Imperial Chemical Industries' third olefin plant at Wilton, England, has made these Works the largest petrochemical venture outside the United States. With a current output of 110,000 tons per year of high-purity ethylene, and a potential output of 140,000 tons, I.C.I. Wilton is an outstanding example of engineering cooperation.



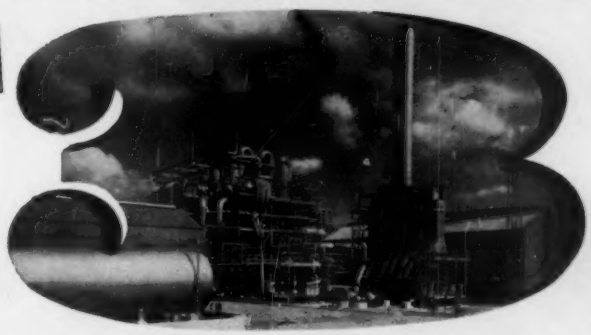
1956

The first plant was commissioned in 1951, and was the first full-scale adoption of the then novel process of oil pyrolysis developed in the Kellogg Laboratories. Its success led to the addition of No. 2 plant in 1956, and then to this latest extension, representing a 60% increase in olefin capacity, in 1959.



1959

Cooperation between client and contractor is the keynote of Kellogg's contribution to chemical engineering. The Wilton Olefin Plant is the largest in the world based on liquid feedstock. Kellogg is proud to have been associated with its development.



To learn more about Kellogg's background in engineering and building olefin plants, at home and overseas, write for current Kelloggram

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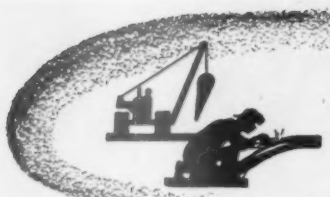


Monthly Report on PIPELINE CONSTRUCTION

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's news section.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, or natural gas.

★ The star symbol indicates the first appearance of the project in the Journal's survey.

U.S. Crude Oil Pipelines

BELLE FOURCHE PIPELINE CO., Box 1612, Casper, Wyo.
Project: 103-mile 8-in. line from Fiddler Creek field to Lance Creek, Wyo., and other lines to serve Roset, Miller Creek, and Lone Tree fields.
Status: Pending approval of Wyoming Public Service Commission.

BUCKEYE PIPE LINE CO., 30 Broad St., New York 4, N. Y.
Project: 54 miles of large-diameter extension in Michigan. The 22-in. line will be extended from Toledo to Samaria, and a 16-in. line will be built from Samaria to Trenton and Detroit.
Status: Under way.
Contractors: Awards made on two of the three sections to Panama-Williams Corp., Houston, and Somerville Construction Co., Ada, Mich.
Completion: Late summer 1960.

CAPE PIPE LINE CO. (Sun Oil Co., Cities Service Co., Atlantic Refining Co.), Philadelphia.
Project: Line from lower Delaware Bay to Philadelphia.
Status: Planned.

GILLETTE PIPELINE, INC., and A. W. HARTWIG, INC.
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approval.

GREAT NORTHERN RAILWAY, St. Paul.
Project: 110-mile line from Lignite and Newburg fields to Minot, N. D.
Status: Has state approval.
Completion: Before next winter.

GULF REFINING CO., Drawer 2100, Houston 1, Tex.
★ Project: 23 miles of reroute of 10-in. near Carlyle, Ill.
Status: Planned.
Completion: December 1960.

INTERNATIONAL OIL PIPELINE CORP., New York.
Project: Would own U. S. section of 1,500-mile, 30-in. line proposed by Mid-Continent Pipe Lines, Ltd., from Edmonton, Alta., to Chicago. (See Canada).
Status: Proposed.

INTERSTATE OIL PIPE LINE CO., Box 1107, Shreveport, La.
★ Project: 20 miles of 8-in. from Soso to Bryan, Miss.
Contractor: Sharman, Allen, Gay & Taylor, Inc., Houston.
Completion: August 1, 1960.

MATADOR PIPE LINE CORP., Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Pending approval of Canadian National Energy Board.

NORTHWESTERN REFINING CO., Box 248, St. Paul Park, Minn.
Project: Gathering system in Rival and Lignite fields, North Dakota.
Status: Has state approval.

SHELL PIPE LINE CORP., Box 2648, Houston 1, Tex.
★ Project: 4½ miles of 8-in. and 6½ miles of 6-in. from East and West Burrwood fields, Louisiana, to existing 8-in. line near Delta Pipe Line's Southwest Pass station.
Status: Planned.
Completion: October 1960.

STANDARD OIL CO. OF CALIFORNIA, San Francisco.
Project: 22 miles of 8-in. from Swanson River Unit to Nikiski on Cook Inlet, Alaska.
Completion: Mid-1961.

U. S. Products Pipelines

CONTINENTAL PIPE LINE CO., Drawer 1267, Ponca City, Okla.
Project: 85-mile 6-in. line from Helena to Great Falls, Mont.
Status: Under way.
Completion: By September 1, 1960.

FARMERS UNION CENTRAL EXCHANGE, INC., Box G, St. Paul 1, Minn.
Project: 200 miles of 8-in. from Glendive, Mont., to Minot, N. D.
Status: Bids received.
Completion: Early fall 1960.

GREAT LAKES PIPE LINE CO., Drawer 2239, Kansas City 42, Mo.
Project: 60 miles of 8-in. from Grinnell to Waterloo, Iowa.
Status: Under way.
Contractor: Shamrock Constructors, Inc.

HUMBLE OIL & REFINING CO., Houston.
Project: About 34 miles of 4-in. from Baytown to Texas City.

HUSKY OIL CO., Cody, Wyo.
Project: About 100 miles from Cody to the Yellowstone products line west from Billings, Mont.
Status: Contracts will probably be let early summer 1960.
Completion: Late 1960.

MID-AMERICA PIPELINE CO., (Missouri-Kansas-Texas Railroad), New York.
Project: 2,300-mile LPG system from West Texas-New Mexico area to upper Midwest. Size of pipe would be 8 and 10-in. with branches 6 to 8-in.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa.
Completion: December 1960.

NEW HAVEN PIPELINE, INC., 515 Madison Ave., New York 22, N. Y.
Project: 12-in. line from New Haven to Hartford, Conn., and 10-in. from there to Springfield, Mass., with a 6-in. spur to Westover Air Base at Ludlow, Mass.
Status: Proposed.

PHILLIPS PETROLEUM CO., Bartlesville, Okla.
Project: 45 miles of 3-in. from Artesia, N. M., to Phillips' Mex.-Tex. line.
Status: Planned.

SEADRIFT PIPELINE CORP. (subsidiary of Union Carbide Corp.).
Project: 108 miles of line from Seadrift to Ella, Tex.
Status: Planned.

SIBON PIPE LINE CO., Houston.
★ Project: 16 miles of 8-in. natural-gas liquids line from Bayou Pigeon to Lake Fausse Point, Iberia Parish, Louisiana.

STANDARD OIL CO. OF CALIFORNIA, 225 Bush St., San Francisco.
★ Project: 20 miles of twin 8-in. line from new Hawaiian refinery to Honolulu.
Status: Under way.
Contractor: Bechtel Corp., San Francisco.

TEXAS EASTERN TRANSMISSION CORP., Box 1189, Houston. (Jointly with Buckeye Pipe Line Co.)
Project: 90-mile extension of Little Big Inch from Lebanon to Lima, Ohio.
Status: Planned.
Completion: Fall 1960.

U. S. Natural Gas Pipelines

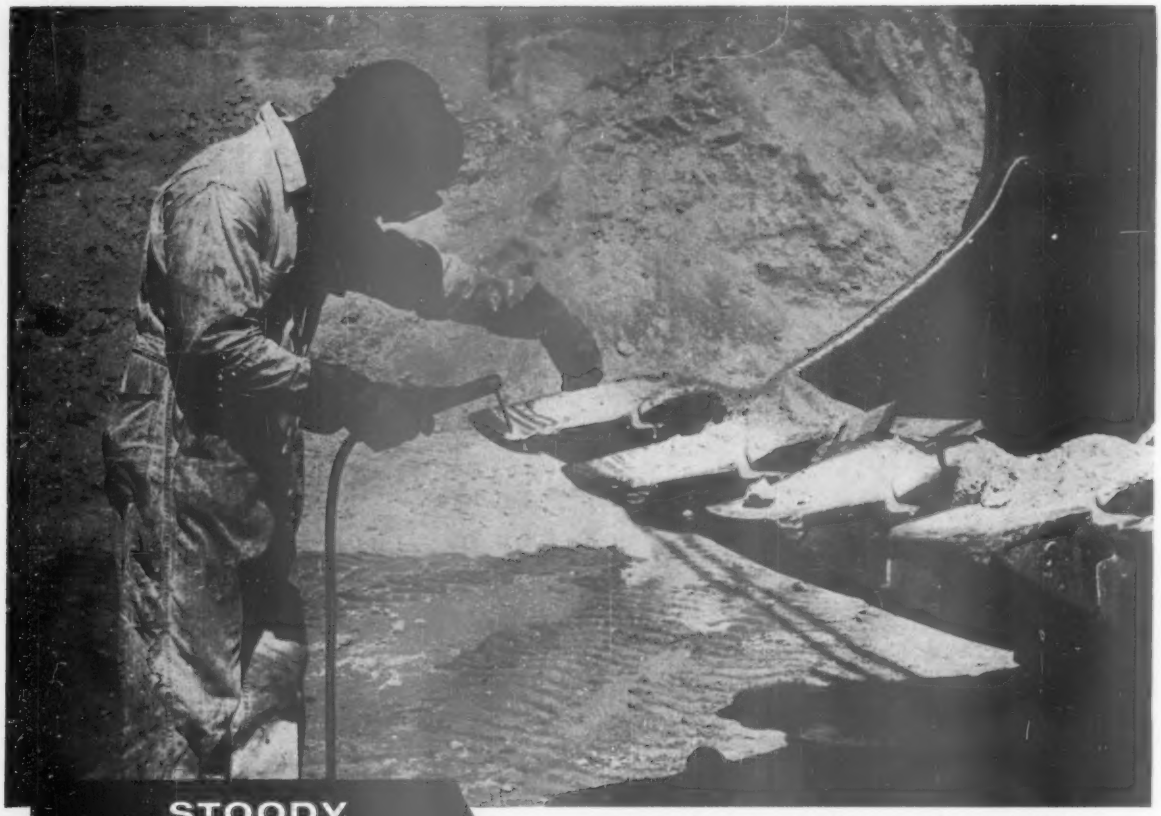
AMERE GAS UTILITIES CO., Box 1273, Charleston 25, W. Va.
Project: 16 miles of 10-in. from Carbon to Wingrove, W. Va.
Completion: Late summer 1960.

ANCHORAGE NATURAL GAS CORP., Houston.
Project: 90 miles of 12-in. from Kenai Peninsula to Anchorage, Alaska.
Status: Pipe being delivered, with construction due in July 1960.
Completion: Late October 1960.

ARKANSAS INDUSTRIAL PIPELINE CORP. (Arkansas Louisiana Gas Co.), Shreveport.
Project: 130 miles of 18-in. from Perla to Helena, Ark.
Contractor: Pentzien, Inc., Omaha, has contract for dual crossing on the Arkansas River near Wright.
Completion: Fall 1960.

ARKANSAS LOUISIANA GAS CO., Shreveport.
Project: About 58 miles of 2, 3, 4, and 6-in. line in various locations.
Completion: 1960.

ATLANTIC SEABOARD CORP., Box 1273, Charleston 25, W. Va.
Project: 45 miles of 20-in. from Terra Alta storage site to Seneca station, W. Va.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa.



TUBE BORIUM *is applied to areas of concentrated wear, such as teeth, for maximum wear protection.*

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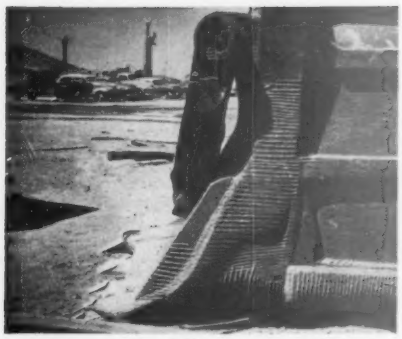
where the going is toughest!



STRINGER BEADS *of Stoody 121 and Stoody 100 applied semi-automatically keep buckets in good condition.*

Usual maintenance procedures just couldn't keep buckets and teeth in shape on this job...wear was too severe. The answer was found in the semi-automatic welder applying Stoody 121 and Stoody 100 to bucket lips, sides, and runners, and to teeth and adapters.

But even then, teeth needed additional protection. To keep them digging efficiently, points were treated twice a day with several beads of Stoody Tube Borium, using manual electrodes. Tube Borium is the "last word" for protecting earth-working equipment where the going is toughest. A few beads virtually form a layer of pure tungsten carbide—your assurance of maximum wear.

Have you investigated the semi-automatic welder and Stoody hard-facing wires in your own operations? Stoody dealers (consult the "yellow pages" of your phone book) are glad to demonstrate the machine in your own plant. Write for details.

STOODY COMPANY

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PIPELINE CONSTRUCTION

Completion: September 1, 1960.

CAROLINA PIPELINE CO., Box 1531, Columbia, S. C.
Project: 12 miles of 6-in. in the Florence, S. C., area.
Status: Under way.
Completion: August 1, 1960.

CENTRAL HUDSON GAS & ELECTRIC CORP., South Road, Poughkeepsie, N. Y.
★ Project: 16 miles of 10-in. from Sleightsburgh to Highland, N. Y.
Status: Under way.
Contractor: C. N. Flagg & Co., Meriden, Conn.
Completion: September 1960.

CITIES SERVICE GAS CO., Box 1995, Oklahoma City 1, Okla.
★ Project: 6 miles of 6-in. at St. Joseph, Mo.
Status: Pending FPC approval.
★ Project: 2 miles of 20-in. at Independence, Kans.
Status: Pending FPC approval.
Project: 13 miles of 16-in. from Alden field, Rice County, Kansas, to the company's Lyons station and 10 miles between Lyons and Wherry.
Status: Approved.

COASTAL STATES GAS PRODUCING CO., 200 Petroleum Tower, Corpus Christi, Tex.
★ Project: 60 miles of 6 and 8-in. line from southeast La Salle County to the Pearsall, Tex., area.
Contractor: Adair Pipeline Co.
Completion: October 1960.

COASTAL TRANSMISSION CORP., Houston.
Project: 65 miles of 3, 4, 6, and 10-in. in Texas and Louisiana.
Status: Pending before FPC.
Completion: Summer 1960.

COLORADO INTERSTATE GAS CO., Box 1087, Colorado Springs.
Project: 7 miles of 20-in. in Texas Panhandle.
Status: Pending FPC approval.
Completion: 1960.
Project: 109 miles of 26-in. from Texas Panhandle to southeastern Colorado; 134 miles of 34-in. from there to Pueblo, and 107 miles of 30-in. on to Denver; 155 miles of 34-in. from Green River, Wyo., to Provo, Utah.
Status: Pending FPC approval.
Completion: 1960.
Project: 32 miles of 6-in. from Central Colorado to Trinidad.
Status: Pending FPC approval.
Completion: 1960.

COLORADO OIL & GAS CORP., Denver.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

COLUMBIA GULF TRANSMISSION CO., Box 683, Houston, Tex.
Project: 6 miles of 24 and 30-in. at Mississippi River crossing near Providence, La.
Status: Approved by FPC.
Completion: November 15, 1960.

EL PASO NATURAL GAS CO., Box 1492, El Paso, Tex.
Project: 19 miles of 20-in., 40½ miles of 16-in., 26 miles of 12-in., and 36 miles of 10-in. from existing 26-in. main line in Cowlitz County, Washington, to Eugene, Ore.
Status: Under way.
Contractors: Hood Construction Co., Whittier, Calif., and River Construction Corp., Fort Worth, Tex.
Completion: Fall 1960.
Project: 17 miles of 5-in. lateral from an interconnection with Pacific Gas Transmission Co.'s proposed 36-in. line in Klamath County to near Klamath Falls, Ore.
Status: Pending FPC approval.
Project: 24 miles of 20-in. from Puckett, Tex., to Goldsmith plant; 51.3 miles of 20-in. from Terrell to Puckett Plant discharge; and 23 miles of 20-in. from Goldsmith to Eunice-Dumas line.
Completion: 1960-61.
Contractor: Western Pipe Line, Inc., Austin, Tex., has contract for 52 miles of 20-in., with work under way.
Project: 244 miles of 30-in. Permian-San Juan Line loops.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex., has contract for 126 miles in New Mexico, with office in Tatum, N. M.
Completion: 1960-61.
Project: 395 miles of 34-in. from Salt Lake City, to California border near Las Vegas, Nev.
Status: Pending FPC approval.
Completion: January 1, 1961.

EQUITABLE GAS CO., 420 Boulevard of the Allies, Pittsburgh, Pa.
Project: 3½ miles of 20-in. in Greene County, Pennsylvania.
Status: Temporarily approved by FPC.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: October 31, 1960.
Project: 17 miles of 16-in. in Marion and Monangalia counties, West Virginia.
Status: Temporarily approved by FPC.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: October 31, 1960.

HOPE NATURAL GAS CO., Clarksburg, W. Va.

photo from Gray's Anatomy, courtesy Longmans Green & Co. Ltd.

OUR VITAL PIPELINES

THE POPLITEAL, POSTERIOR TIBIAL AND PERONEAL ARTERIES — The main arteries supplying the leg, from the thigh to the ankle, with fresh blood. Thanks to these arteries, man is able to walk head and shoulders above all other forms of living matter.

Pipelines that supply our refineries with crude oil for gasoline and jet fuels are much like the arteries of the body's leg — as vital to progress as life itself.

From the field to the consumer — vital pipelines are built better Majestically.

from the field direct to the consumer

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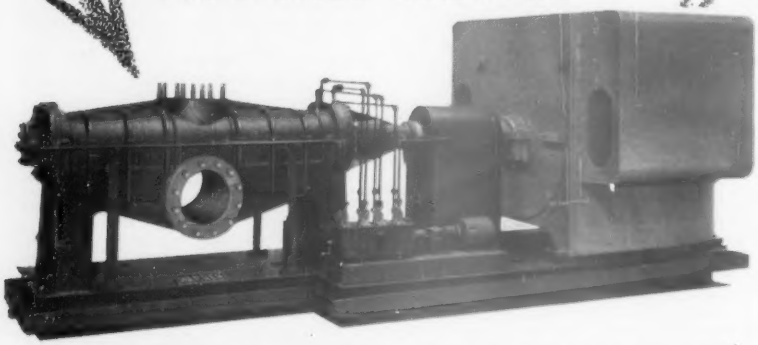
CONTRACTORS, INC.
HEAD OFFICE: 1902 TENNESSEE BUILDING, HOUSTON, TEXAS

WARREN'S

MAJOR CONTRIBUTION to more efficient and reliable PIPE LINE SERVICE



the WARREN HIGH PRESSURE SCREW PUMP

This Warren #8CB Screw Pump is one of three recently shipped for an important pipe line job. It is designed for 560 GPM of 1400 SSU viscosity refinery bottoms at 800/1000 PSIG discharge pressure. The drive is a 400 HP, 870 RPM direct connected electric motor. Pump body is ductile iron. Notice the separate force feed lubricator for bearings and mechanical seal.

EFFICIENT—On either high or relatively low viscosities, this Warren High Pressure Screw Pump offers exceptional operating economies—with efficiencies of 75% to 85%.

RELIABLE—It delivers constant, pulseless flow which assures minimum pipe line stresses. And capacity change due to viscosity variation is negligible.

Bearings can be lubricated either externally or by the product being pumped—with or without filtering. For even longer wear without servicing, body bores and screws can be hard surfaced.

Its increasing use at many unattended stations is adding to its reputation for reliability.

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O-2

PIPELINE CONSTRUCTION

Project: 20 miles of 24-in. line in Wetzel and Monongalia counties, West Virginia, replacing two 16-in. lines.
Status: Approved.
Contractor: Sheppard-Geiger Construction Co., Corpus Christi, Tex.

HOUSTON TEXAS GAS & OIL CORP., Box 10400, St. Petersburg 33, Fla.
Project: 235 miles of 2 to 6-in. lateral lines.
Status: Pending FPC approval.

IRON RANGES NATURAL GAS CO., St. Paul.
Project: 79 miles of 10 and 12-in. from Grand Rapids to Hoyt Lake, Minn., and 67 miles of 12-in. from Duluth to Silver Bay, Minn.
Status: Approved by FPC.
Completion: 1960.

KANSAS-NEBRASKA NATURAL GAS CO., INC., Phillipsburg, Kans.
Project: Enlargement of gathering facilities in Hugoton field, Kansas, including 8 miles of 8-in., 10 miles of 20-in., and 1 mile of 26-in.
Contractors: Groninger & King, Inc., Pampa, Tex.
Completion: August 1, 1960.
Project: 12 miles of 4-in. in Kimball, Neb., area.
Completion: July 15, 1960.
Project: 56 miles of 2-in. to serve several communities in Kansas.
Completion: August 1, 1960.

LONE STAR GAS CO., 301 S. Harwood, Dallas, Tex.
Project: 48-mile 20-in. line from Springtown to Irving, Tex.
Status: Under way.
Completion: September 1960.

LO-VACA GATHERING CO. (subsidiary of Coastal States Gas Producing Co., 200 Petroleum Tower, Corpus Christi, Tex.).
★ Project: 230 miles of 6 to 20-in. line from Live Oak County to Lavaca County, Texas.
Status: Pending FPC approval.
Completion: Late 1960 or early 1961.

MANUFACTURERS LIGHT & HEAT CO., Union Trust Building, Pittsburgh 19, Pa.
Project: 70 miles of 20-in. from Sideling Hill Mountain to Abbottstown, Pa.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa, Okla.
Completion: September 1960.
Project: 33 miles of 20-in. from Point Marion to Route 40 near Addison, Pa.
Completion: September 1960.
Project: About 8 miles of 4 to 16-in. line in the Victory storage area, West Virginia.
Completion: September 1960.

MICHIGAN WISCONSIN PIPE LINE CO., 500 Griswold Street, Detroit 26, Mich.
Project: 342½ miles of 24-in. and 192 miles of 30-in. main-line loops.
Status: Pending FPC approval.
Contractors: R. H. Fulton & Co., Lubbock, Tex.; Bechtel Corp., San Francisco; Majestic Contractors, Inc., Houston; and Somerville Construction Co., Ada, Mich.
Completion: November 1, 1960.
Project: 92 miles of 24-in. from Appleton to Marshfield, Wis.
Status: Under way.
Contractor: Houston Contracting Co.
Completion: October 1, 1960.
Project: 85 miles of 16-in. from Weyauwega to Marinette, Wis.
Status: Under way.
Contractor: Hallmac Construction Co., Houston.

PROTECTION
is our business

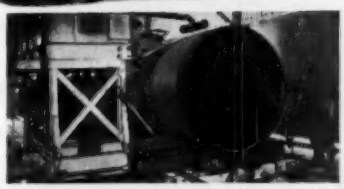
The protection of pipe lines is a major concern with Nicolet Industries. Every product that bears the name of Nicolet is the finest of its kind. That is why NICOLET ASBESTOS PIPE LINE FELTS and NICOLET "OLD NIC" GLASS WRAP are so widely used and specified.

And, that is why so many forward looking Mill Wrap operations rely heavily upon Nicolet Pipe Wraps.

We are proud of the important part we play in the complete pipe protection provided by the better Mill Wrap and Over-The-Ditch operators.

To continue to merit the confidence placed in Nicolet Pipe Line Felts and Glass Wrap, Nicolet maintains the most rigid of Quality Control Systems. From our Asbestos Mines to finished product, you are assured of complete adherence to specifications.

More and more Corrosion Engineers are specifying Nicolet Asbestos Pipe Line Felts and Nicolet "Old Nic" Glass Wrap. You, too, should write today for samples and specifications.



Mill wrapping with Nicolet Felt at Pipe Protection Service, Inc., Kearny, N. J.

72" pipe wrapped with Nicolet Felt by Pipe Protection Service, Inc.

Nicolet Industries, Inc., Florham Park, New Jersey

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gets the job done"

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PIPELINE CONSTRUCTION

Project: 111 miles of various 4 to 8-in. laterals in Wisconsin.
Status: Under way.
Contractor: Panama-Williams Corp., Houston.
Completion: October 1, 1960.
Project: 31 miles of various 4 to 6-in. laterals in Wisconsin.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: October 1, 1960.
Project: 41 miles of various 4 to 6-in. laterals in Iowa and Missouri.
Status: Approved by FPC.
Completion: September 1, 1960.

MIDWESTERN GAS TRANSMISSION CO., Houston.
Project: 504 miles of 24-in. from Emerson, Man., to Marshfield, Wis., plus 54 miles of sales laterals.
Contractors: Stanley-Bledsoe Corp., Tulsa and Rosson-Richards Processing Co., Houston, have internal cleaning and coating contracts. Houston Contracting Co. will build 2 compressor stations and 21 meter stations. H. C. Price Co., Bartlesville, has 154-mile double-jointing contract.
Completion: November 1, 1960.

MISSISSIPPI RIVER FUEL CORP., 407 North 8th Street, St. Louis 1, Mo.
Project: 5 miles of 16-in. and 15 miles of 12-in. from Collinsville, Ill., to St. Jacob, Ill.
Status: Pending FPC approval.

MISSISSIPPI RIVER TRANSMISSION CORP. (Mississippi River Fuel Corp.), St. Louis.
★ Project: 94 miles of 18-in. from Johnsonville, Ill., to the St. Louis area.
Status: Pending FPC approval.
Project: 115 miles of 24-in. from near Oran in Southeast Missouri to St. Louis County.
Status: Planned.
Completion: Last half 1960.

MONTANA-DAKOTA UTILITIES CO., 831 Second Ave., S., Minneapolis.
Project: 13 miles of 10 and 12-in. loop near Mandan, N. D.
Status: Under way.
Contractor: Sterling Construction Co., Sterling, Colo.
Completion: July 30, 1960.

MOUNTAIN FUEL SUPPLY CO., 180 East 1st South Street, Salt Lake City.
★ Project: 20 miles of 20-in. from Piedmont to Yellow Creek.
Status: Pending approval.
Completion: October 9, 1960.
Project: 7 miles of 24-in. from Mountain Dell to Salt Lake City.
Status: Pending approval.
Contractor: Pease Brothers Co., Vernal, Utah.
Completion: August 8, 1960.
Project: 6 miles of 20-in. from Kanda Junction to Green River, Wyo.
Status: Pending approval.
Completion: August 8, 1960.

NATURAL GAS GATHERING CO., INC., Corrigan Tower, Dallas, and **GULF RESOURCES, INC.**
Project: 31 miles of 10, 12, and 14-in. in Zapata and Starr counties, Texas.
Status: Pending FPC approval.
Completion: Fall 1960.

NATURAL GAS PIPELINE CO. OF AMERICA, 122 South Michigan Avenue, Chicago.
Project: 188 miles of 24 and 139 miles of 36-in. loops in Oklahoma, Kansas, and Iowa.
Status: Pending FPC approval.
Completion: Fall 1960.

Save 10%-25% per year on your pipeline power costs with *Gýrol*® Fluid Drive. By adjusting pump speed to demand, Gýrol Fluid Drive maintains throughput with lowest possible power consumption. Annual power costs may be reduced as much as 25%. Infinitely adjustable in speed, Gýrol Fluid Drive gives you complete flexibility of flow and pressure, regardless of rate of flow required by changes in viscosity or specific gravity. And it's easily adaptable to unattended operation. For the full savings' story, write for Bulletin A-519 or call our nearest office. American-Standard* Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Ltd., Toronto, Ont.

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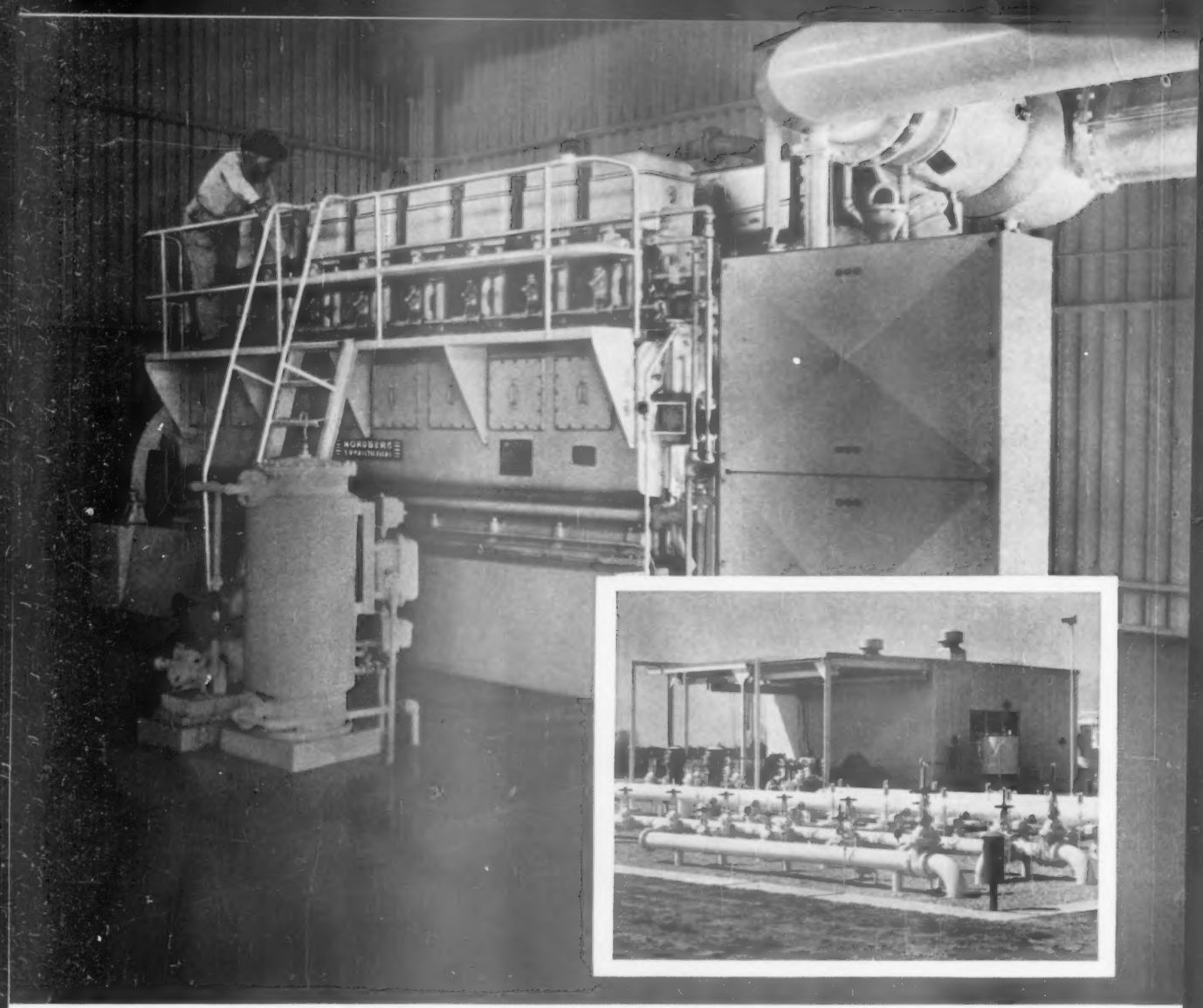

Pipe line engines by Nordberg

One of two Nordberg 2000 hp dual fuel engines powering main line pumps at the Teague, Texas station of Sinclair Pipe Line Co. All mechanical equipment is lease-rented from Nordberg. Note that building houses only the engines. Pumps, gears, and most auxiliaries are outside.

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NORDBERG MANUFACTURING COMPANY
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WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO D. F.

PIPELINE CONSTRUCTION

Project: 30-in. Missouri River crossing in Cass County, Neb., and 24-in. Big Blue River crossing in Gage County, Nebraska.
Status: Planned.
Completion: Summer 1960.
Project: 12 miles of 3, 4, and 6-in. gathering system in Wise County, Texas.
Status: Under way.
Project: 5 miles of 8-in. Chitwood lateral line in Grady County, Oklahoma.
Status: Pending FPC approval.
Project: 18 miles of 4 to 10-in. Smith-Collins gathering system in Carson County, Texas.
Status: Pending FPC approval.

NIAGARA MOHAWK POWER CORP., Syracuse, N. Y.
Project: 104 miles of 12-in. from Watertown, N. Y., to Massena, N. Y.
Status: Planned.
Completion: November 1960.
Project: 22 miles of 6-in. from Massena to Malone, N. Y.
Status: Planned.
Completion: November 1960.
Project: 17 miles of 6-in. from Watertown to Carthage, N. Y.
Status: Planned.
Completion: September 1960.

NORTHERN ILLINOIS GAS CO., 50 Fox Street, Aurora, Ill.
Project: 75 miles of 30-in. from Troy Grove storage field to LaGrange, Ill.
Status: Under way.
Contractor: Contracting & Material Co., Evanston, Ill.
Completion: Early fall 1960.

NORTHERN NATURAL GAS CO., Omaha.
Project: 217 miles of main line, 221 miles of main-line loops, and 2,178 miles of branch lines of various diameters.
Completion: 900 miles were completed in 1959.
Project: About 21 miles of 16-in. and 26 miles of various small diameter pipeline in the Glick field, Kansas, area.
Status: Pending FPC approval.
Project: 188 miles of 24-in. and 215 miles of 30-in. from Farmington, Minn., to International border.
Status: Proposed.
Project: 83 miles of 20-in. from East Dubuque, Ill., to Janesville, Wis.
Status: Pending FPC.
Completion: Fall 1960.

OHIO FUEL GAS CO., 99 North Front Street, Columbus 15, Ohio.
Projects: About 28 miles of 5 to 20-in. line in various places in Ohio.
Completion: Summer and fall 1960.

OKLAHOMA RESOURCES DEVELOPMENT CO., Cameron Building, Oklahoma City.
Project: About 170 miles of 12-in. trunk line from Oklahoma City to Harrah and Muskogee, Okla., and about 130 miles of 4 to 12-in. lateral from Hughes County and from Blaine and Logan counties.
Status: Planned.
Completion: November 1, 1960.

OLD OCEAN FUEL CO. (subsidiary of Texas Electric Service Co.). Fort Worth.
Project: 364 miles of 16, 20, and 24-in. from the Gulf Coast south of Houston to the Fort Worth area.
Status: Under way.
Contractors: H. B. Zachry Co., San Antonio, Tex., and O. R. Burden Construction Corp., Tulsa, Okla.
Completion: December 1960.

PACIFIC GAS & ELECTRIC CO., San Francisco.
Project: 9 miles of 12-in. from Berenda Creek to Chowchilla, Calif.
Status: Planned.
Contractor: Company crews.
Completion: 1960.
Project: 8 miles of 16 and 2 miles of 10-in. Fresno reinforcement.
Status: Planned.
Contractor: Company crews.
Completion: 1960.
Project: 7 miles of 16-in. from Ignacio to Petaluma, Calif.
Status: Planned.
Contractor: Company crews.
Completion: 1960.
Project: 67 miles of line from Kettleman Hills to Morro Bay, Calif.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1961.
Project: 11 miles of 20-in. from Pittsburg to Walnut Creek, Calif.
Contractor: Using company crews.
Completion: 1960.
Project: 296 miles of 36-in. from the California-Oregon border to Antioch, Calif.
Status: Pending state approvals.
Completion: 90 miles scheduled for completion in 1960, the rest in 1961.

PACIFIC GAS TRANSMISSION CO. (Pacific Gas & Electric, San Francisco).
Project: 614 miles of 36-in. from Kingsgate, B. C., to California border near Klammath Falls, Ore.
Status: Has FPC examiner's approval.

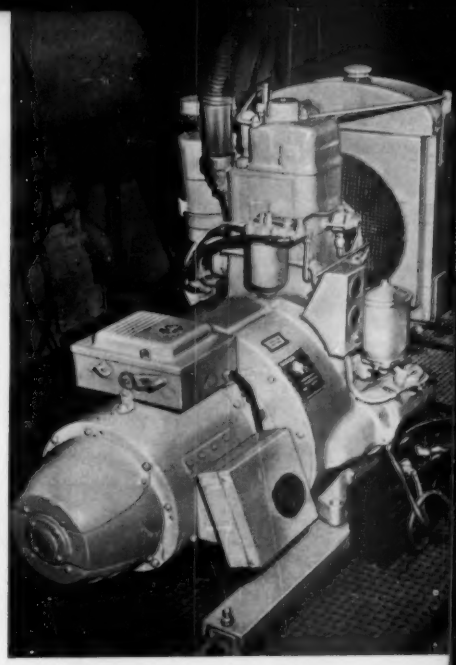
PACIFIC LIGHTING GAS SUPPLY CO., Los Angeles.
Project: 116 miles of 34-in. from Needles to Newberry, Calif.
Status: Under way.
Contractors: Engineers Limited Pipeline Co., San Francisco, Pacific Pipeline Construction Co., Montebello, Calif., and Missouri Valley Dredging Co., Omaha.
Completion: July 15, 1960.

PANHANDLE EASTERN PIPE LINE CO., 1221 Baltimore Avenue, Kansas City, Mo.
★ Project: 50 miles of 22-in. and 150 miles of 24-in. from Haven, Kans., to Elk City, Okla.
Status: Pending FPC approval.
Completion: December 31, 1960.
Project: 300 miles of 30-in., 18 miles of 26-in., 9 miles of 12-in., 29 miles of 8-in., and 40 miles of 6-in. loop.
Status: Pending FPC approval.
Completion: December 31, 1960.
Project: 141 miles of 4 to 16-in. gathering line.
Contractor: Hall Construction Co., Liberal, Kans.
Completion: December 31, 1960.

PEOPLES GAS LIGHT & COKE CO., 122 South Michigan Avenue, Chicago 3, Ill.
Project: 29 miles of 36-in. in the Chicago area.
Status: One portion under way.
Completion: 1960-62.

PEOPLES GULF COAST NATURAL GAS PIPELINE CO., 122 South Michigan Avenue, Chicago 3, Ill.
Project: 371 miles of loop of present ent system between Texas and Chicago.
Status: Pending FPC approval.
Completion: November 15, 1960.
Project: About 59 miles of various size looping of main line in Texas.
Status: Pending FPC approval.
Completion: October 12, 1960.

PEOPLES NATURAL GAS CO., Two Gateway Center, Pittsburgh 22, Pa.
Project: 37 miles of 12 and 20-in. in various parts of Pennsylvania.
Contractor: Joyce Western Corp. has contract for 8 miles of 20-in. from Imperial to Aliquippa, Pa.
Completion: From June to October 1960 for most of the line.



Power Chief® oil field engines for rig lighting

Power Chief Diesel Electric Generator Sets are furnishing reliable lighting on large and small rigs. These sturdy units can stand the gaff of continuous service, night after night, without constant attention and maintenance.

Built in 1, 2 and 3-cylinder sizes, Power Chief Diesels develop from 10 to 45 hp, 5 to 30 kw, in all standard AC and DC voltages . . . and are available with special vibration-proof mounting for rig installation.

NORDBERG MANUFACTURING COMPANY

MILWAUKEE 1, WISCONSIN

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New Safety! *for compressor stations*

GARRETT SAFETY SHUT-IN SYSTEM

HERE'S HOW IT WORKS

The station operator trips remote control **A, B or C.**

STATION ISOLATED

Suction firegate closes

Discharge fire gate closes

PRESSURE DISCHARGED

Suction relief valve opens

Discharge Relief Valve opens

Compressor unit relief valves open

ENGINE SHUT DOWN

Fuel gas relief valve opens

Tripping a single remote control instantly isolates a compressor station from the main line while simultaneously cutting off engine fuel and blowing down internal lines in Garrett's new safety shut-in system.

The station can be restored to service quickly without purging of lines. Block valves permit continued operation of station during periodic blow down testing of valves without loss of thousands of dollars in gas.

Designed to work with relief valves normally installed at compressor stations and with existing engine starting air pressure . . the Garrett safety shut-in system may be obtained for little more than the cost of adding "type EO" operators to the existing relief valves.

Check with your nearby Garrett representative or write direct for the full story of this NEW safety shut-in system for your compressor stations.

USI **Garrett Oil Tools**

DIVISION OF U. S. INDUSTRIES, INC.
P. O. BOX 2427, LONGVIEW, TEXAS

PIPELINE CONSTRUCTION

PHILLIPS PETROLEUM CO., Bartlesville.
Project: 85 miles of 2 to 16-in. gathering lines in Eddy County, New Mexico.
Status: Under way.
Contractor: Lasley Construction Co.
Completion: October 16, 1960.

PIONEER NATURAL GAS CO., Amarillo.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex. northward.
Status: Pending FPC approval.

PUBLIC SERVICE CO. OF NORTH CAROLINA, Gastonia, N. C.
Project: About 47 miles of 4, 8, and 10-in. in North Carolina.

RIO GRANDE VALLEY GAS CO., Box 391, Brownsville, Tex.
★ Project: 60 miles of 12-in. in Hidalgo, Starr, and Jim Hogg counties from Moore field area to Prado field area, replacing and reconditioning existing line.
Status: Planned.
Completion: 1961.
★ Project: 5 miles of 6-in. from Moore field area to North Monte Christe field, Hidalgo County.
Status: Planned.
Contractor: Own forces.
Completion: December 1960.
★ Project: 3½ miles of 12-in. in South Weslaco field area, Hidalgo County.
Status: Planned.
Contractor: Own forces.
Completion: December 1960.

ROCKY MOUNTAIN NATURAL GAS CO.
Project: 65 miles of gas line in southwestern Colorado to supply Collbran, Montrose, Delta, and Orchard City.
Status: Planned.

SOUTH TEXAS NATURAL GAS GATHERING CO. (subsidiary of Coastal States Gas Producing Co., 200 Petroleum Tower, Corpus Christi, Tex.).
★ Project: 30 miles of 12-in. from south Jim Wells County to the May field area in Kleburg County, Texas.
Status: Pending FPC approval.
Completion: September 1960.
★ Project: 40 miles of 4 to 14-in. line in northwest Jim Hogg County to south Zapata County, Texas.
Status: Planned.
Completion: Late 1960 or early 1961.

SOUTHERN CALIFORNIA GAS CO., Los Angeles.
Project: 13 miles of 34-in. from San Fernando Valley to West Los Angeles.
Status: Approved.
Completion: 1960.

SOUTHERN CALIFORNIA GAS CO., and SOUTHERN COUNTIES GAS CO. OF CALIFORNIA, Los Angeles.
Project: 93 miles of 34-in. from Ivanpah to Newberry, Calif.
Status: Pending FPC approval.
Completion: 1961.
Project: 115 miles of 36-in. from Newberry to Placentia, Calif.
Status: Under way.
Contractors: Young & Anderson Co., Brea, Calif., has contract for 85 miles from Newberry to Fontana. Contractors for the remainder are Hood Construction Co., Whittier, Calif.; J. P. Neill & Co., Dallas; and River Construction Corp., Fort Worth, Tex.
Completion: August 1960.

SOUTHERN NATURAL GAS CO., Box 2563, Birmingham, Ala.
★ Project: 15 miles of 8 and 10-in. in Marion and Walthall counties, Mississippi.
Status: Under way.

NOW—Complete Anchoring Service

- ENGINEERING
- TESTING
- INSTALLATION

Use the Chance Field Service Plan . . . the surest, easiest, most reliable, and least expensive way to anchor pipelines. You'll cut costs about 85% by using Chance Screw Anchors and tie-down brackets. And, you can have the whole project engineered, installed, and tested by qualified technicians at far less cost than counter weighting.

Chance application engineers will conduct soil test probes (photos A & B) to determine where anchors should be installed, the size anchors needed, and the proper anchoring depth. Pull tests (photo C) will verify their recommendations. Then, for a reasonable fee, Chance will provide special installation equipment, and the services of an installation supervisor.

Here's one job you can leave to *Chance!* You'll save money, too, because Chance Anchors cost much less than counter weights. And, they're lighter and less bulky than counter weights . . . cheaper to transport, easier to store. A complete unit (two anchors and one bracket) weighs from 29 to 180 pounds, and will hold 5,000 to 30,000 pounds.

Call or write for complete information on the Chance Field Service Plan.

Phone: CApitol 8-2777

Petroleum Equipment Engineering and Services Division of

A. B. CHANCE CO.

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INTERNATIONAL DIVISION • CENTRALIA, MO., U. S. A.

now... three

PARTNERS IN JOHNS-MANVILLE PIPELINE PROTECTION

Now one single source takes on complete responsibility for any field wrapping job in pipeline protection! Johns-Manville manufactures wraps to meet every soil condition, every pipe wrap requirement. An enlarged staff of sales and technical personnel operates out of 13 sales offices . . . backed by modern research and development laboratories and 4 strategically-located plants. You can get further information by writing Johns-Manville, Box 158, Dept OG-627, New York City 16, or in Canada at Port Credit, Ontario.

1

FOR ENAMEL REINFORCEMENT

J-M BLUE FLAG WRAP

This wrap is specially-formulated from borosilicate type fiber glass that can't rot, decay or absorb moisture. Uniformly porous, Blue Flag allows enamel to bleed through quickly to minimize holidays and helps form an evenly distributed coating with high resistance to soil stresses. Adds years of protective life.

2

FOR A TOUGH OUTER SHELL

J-M ASBESTOS FELTS

They resist soil stress, earth movement and rock pressures . . . withstand damage from handling, backfilling and other installation hazards. Felts are made of asbestos, a fibrous stone. In manufacturing, these fibers are felted, then impregnated with a coal tar or asphalt saturant to provide, literally, a flexible covering of stone.

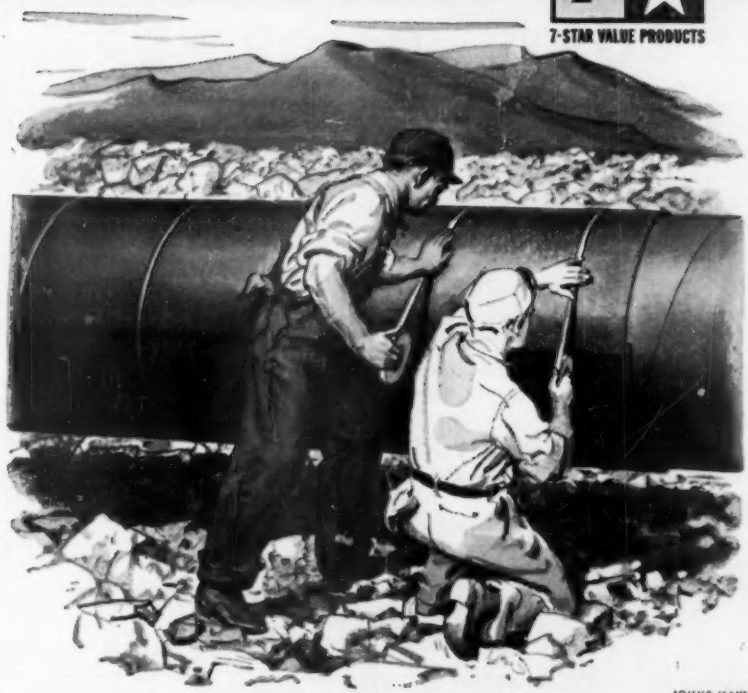
JOHNS-MANVILLE J-M 7★ 7-STAR VALUE PRODUCTS

3

AND NOW

J-M FLEXIBLE ROCK SHIELD!

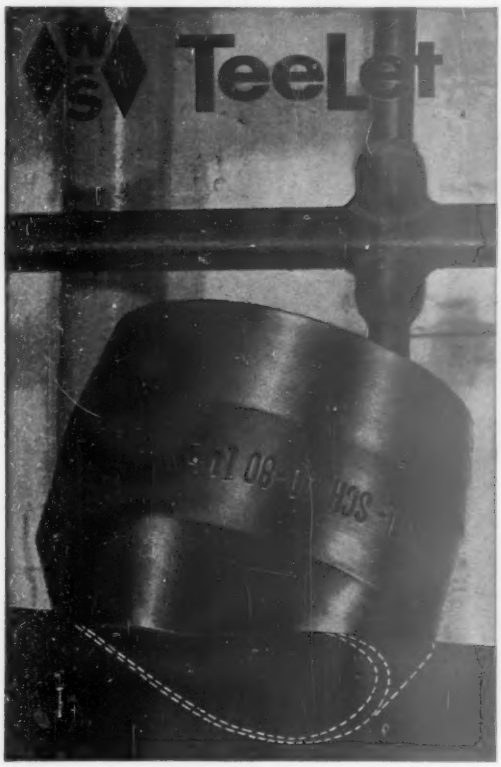
It provides an added shield for pipe coating on lines running through rocky, rugged terrain. J-M Flexible Rock Shield is a tough asphalt mastic board . . . a resilient padding that forms an extra cushion against rupture and impact. J-M Flexible Rock Shield is a low cost way to prevent high cost maintenance problems.



JOHNS-MANVILLE

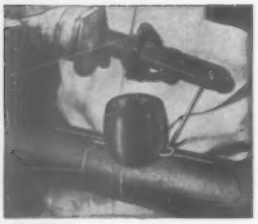
JOHNS-MANVILLE JM PRODUCTS

FOR ⅛ TO 1½ INCH BRANCH CONNECTIONS



MARK

CUT



WELD

NEW W-S TeeLet SLASHES TEE COSTS 50% OR MORE!

The new W-S TeeLet replaces conventional Tees of cast or malleable iron, welded or forged steel . . . requires fewer stock sizes. Available in sizes from ⅛ to 1½" IPS, TeeLets are fully machined from forging quality solid steel bars and adapt to run-pipe sizes to 36". They require no additional joint strength calculations for any ASTM A-53 or A-106 Grade B run-pipe of Schedule 40 or 80.

What about cost? A size-by-size comparison with conventional Tees shows TeeLets average less than 50 per cent of the cost you now pay. A W-S TeeLet, with screwed, socket-weld or butt-weld ends, requires no shaping, fitting, beveling or extra alignment. You can connect to the run-pipe at any point. Short heights mean easy inspection of the attachment weld or back-weld, if desired.

A W-S TeeLet costs less to buy, less to install than anything you can buy or make. For complete information, prices, and names of distributors, write: *Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.*

FORGE AND PORTER FITTINGS DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

PIPELINE CONSTRUCTION

Contractor: Harbert Construction Corp., Birmingham, Ala.

ST. LAWRENCE GAS CO., Ogdensburg, N. Y.
Project: 75 miles of line from Cornwall, Ont., to Ogdensburg, N. Y.
Status: Pending FPC approval.

TENNESSEE GAS PIPELINE CO., a division of Tennessee Gas Transmission Co., Box 2511, Houston 1, Tex.
Project: 21 miles of 16-in. gathering line from Louisiana coast to Block 46 in the Vermilion area.
Status: Pending FPC approval.
Project: 2 miles of 12-in. gathering line from Block 66 to Block 64, East Cameron area, offshore Louisiana.
Status: Pending FPC approval.
Project: 158 miles of 36-in. loop lines at various points between Kinder, La., and Centerville, Tenn.
Status: Approved by FPC.
Project: 11½ miles of 16-in., 44 miles of 12-in., and 10 miles of 10-in. off Louisiana coast.
Status: Pending FPC approval.
Project: 12 miles of 12-in. gathering line from Louisiana coast to Block 17, East Cameron area, offshore Louisiana.
Status: Approved by FPC.
Project: 191 miles of 30 and 36-in. loop at various points in Ohio, Pennsylvania, and New York.
Status: Pending FPC approval.

TEXAS EASTERN TRANSMISSION CORP., Shreveport, La.
Project: 85 miles of 24-in. from Tamarack, to Perulack, Pa.
Status: Pending FPC approval.
Project: 40 miles of 36-in. from Lambertville, to Linden, N. J.
Status: Pending FPC approval.
Project: 23 miles of 20-in. from Eagle, to Chester Junction, Pa.
Status: Pending FPC approval.
Project: 53 miles of 30-in. from Perulack, Pa., to Lambertville, N. J.
Status: Pending FPC approval.

TEXAS GAS TRANSMISSION CORP., Box 577, Owensboro, Ky.
★ Project: 29 miles of 12-in. from Slaughters to Greenville, Ky.
Status: Planned.
★ Project: 9½ miles of 8-in. from Calhoun field to Downsville, La.
Status: Under way.
Completion: August 1, 1960.
Project: 24 miles of 30-in. south of Bastrop, La., and 56 miles of 12-in. loop in Indiana.
Status: Pending FPC approval.
Completion: Fall 1960.

TRANSCONTINENTAL GAS PIPE LINE CORP., 3100 Travis St., Houston, Tex.
★ Project: 23 miles of 20-in. offshore Louisiana.
Status: Under way.
Contractor: Brown & Root, Inc., Houston.
Completion: 1960.
★ Project: 73 miles of 8 to 16-in. offshore Louisiana.
Status: Approved by FPC.
Completion: 1960.
★ Project: 14 miles of 20-in. in New Jersey and Pennsylvania.
Status: Approved by FPC.
Completion: 1960.
Projects: 7 miles of 16-in., 69 miles of 30-in., and 269 miles of 36-in. in various states.
Status: Pending FPC approval.
Completion: 1960.

TRANSWESTERN PIPELINE CO., Houston.
Project: 300 miles of 4, 6, and 8-in. gathering lines in the Texas Panhandle,

cost-cutting gas boosters

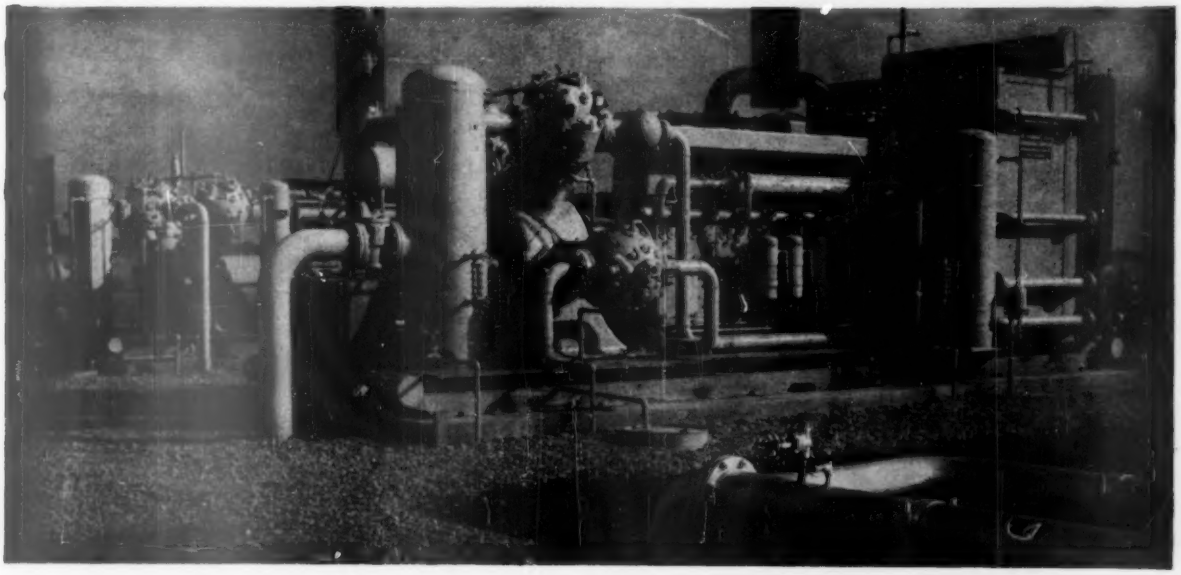
In a recent 12-month period, Sunray Mid-Continent Oil Company installed 11 "packaged" gas compressors, each dependably powered by a White Superior gas engine. Every day 4050 HP from the Superiors drives compressors that deliver 37,475,000 cubic feet of gas for Sunray's expanding gathering program!

Throughout gas and oil fields, rugged, compact Superior engines are proving economical, both in purchase price and operating costs. For example, because of the ability of Superior engines to deliver required HP at low speeds, the engines are directly coupled in engine-compressor packages. This eliminates the need for expensive gear reducers, results in smooth continuous performance and low fuel consumption.

Superiors' extreme design simplicity, precision construction and many advanced engineering refinements reduce maintenance and repair and greatly prolong engine life.

Superior engines are available in diesel, dual-fuel and gas engines from 190 to 2150 HP and in portable or stationary generator sets from 150 to 1500 KW. Get complete information from leading oil field distributors, White oil field representatives, or through White Diesel Engine Division.

Sunray Mid-Continent expansion program includes 11 new Superior-powered compressors

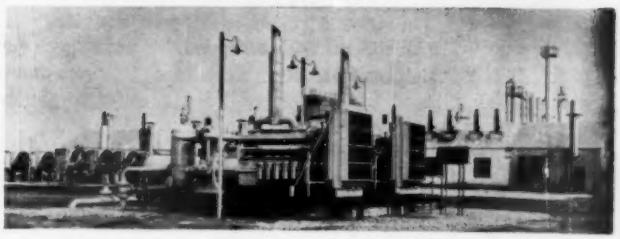


Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

Superior 8G-825 eight-cylinder gas engines driving gas boosters at Sunray's West Moore Field, Cleveland County, Oklahoma.



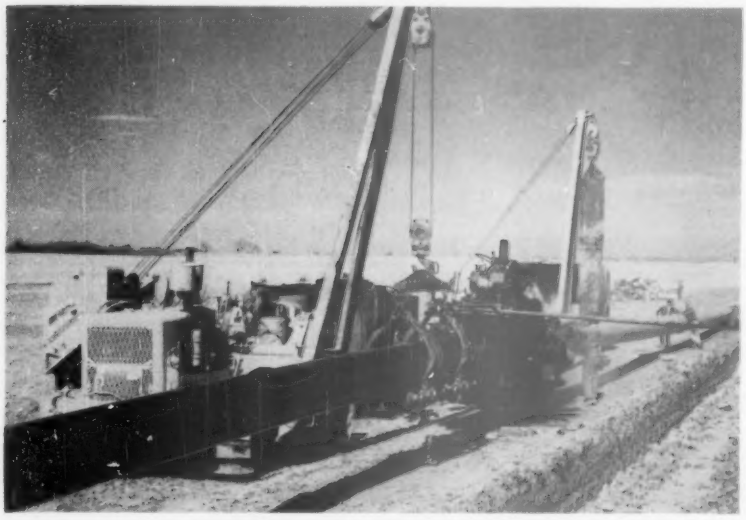
PIPELINE CONSTRUCTION

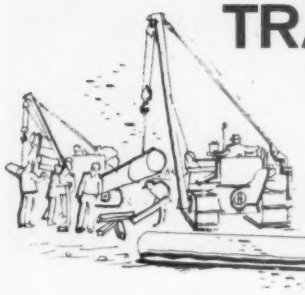
northwestern Oklahoma, Southwest Texas, and southeastern New Mexico.
Contractor: Sheehan Pipe Line Construction Co., Tulsa.
Completion: July 15, 1960.

TRUNKLINE GAS CO., Box 1642, Houston.
Project: 31 miles of 30-in. from Longville to Pitkin, La.; 58 miles of 30-in. from Riverton to Kilbourne, La.; 63 miles of 30-in. from Ballentine, Miss., to Canadaville, Tenn.; 65 miles of 30-in. from Bardwell, Ky., to Marion, Ill.; and 35 miles of 30-in. from Neoga to Bourbon, Ill.
Contractor: Stanley-Bledsoe Corp., Tulsa, has double-jointing contract for 78 miles in Mississippi, Tennessee, and Louisiana.
Project: 140 miles of supply lateral in South Louisiana, including a 17-mile 24-in. loop of an existing lateral and 123 miles of 20, 24, and 26-in.
Status: Pending FPC approval.
Completion: Fall 1960.
Project: 177 miles of 30-in. loops in Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky.
Status: Under way.
Contractor: Panama, Inc., Houston.
Project: 62 miles of 26-in. extension from Bourbon to Rossville, Ill.
Status: Under way.
Contractor: Contracting & Material Co., Evanston, Ill.

UNION HILL STORAGE CO., 122 S. Michigan Ave., Chicago 3, Ill.
★ Project: 7½ miles of 12-in. in Mahomet field pilot system, Illinois.
Status: Pending FPC approval. Bids called for.
Completion: August 12, 1960.

UNITED GAS PIPE LINE CO., Box 1407, Shreveport 92, La.
Project: 59 miles of 36-in. purchase lateral connecting Bastian Bay field, Louisiana.
Status: Pending FPC approval.
Completion: Fall 1961.





TRANSWESTERN IS BUILDING FOR ENDURANCE!

The Transwestern Pipeline Company line, with 1600 miles under construction from Fort Stockton, Texas and the Texas Panhandle to near Needles, California, will serve West Coast consumers with natural gas for many, many years to come. Its underground lines and structures are being installed with coal-tar enamel coating for high integrity electrical insulation and life-long corrosion protection. Reilly Hot Service Enamel with HS X-10 Primer and Reilly Intermediate Enamel with Q.D. Primer have been specified along with Coal Tar Enamels of other manufacturers and will serve as the engineering material of choice for corrosion mitigation.

Reilly COAL TAR PRODUCTS

REILLY TAR & CHEMICAL CORP.
1615 Merchants Bank Building
Indianoplis 4, Indiana

ARMEO Protective Coatings

Canadian Crude Oil Pipelines

ACT OILS, LTD.
Project: A 450-mile line from the Peace River region to tidewater at Kitimat, B. C.
Status: Proposed.

BITUMINOUS OIL PIPELINE CO. (Royalite Oil Co., and Can-Amera Oilsands Development, Ltd.)
Project: A 250-mile line from Athabasca oil sands to Edmonton.
Status: Proposed.

FEDERATED PIPE LINES, LTD., 304 Sixth Ave., SW., Calgary, Alta.
Project: 14 miles of 6-in. and 18 miles of 8-in. in Swan Hills area, Alberta, and 41½ miles of line from Oliver to Highbridge, Alta.
Status: Under way.
Contractor: Majestic Contractors, Ltd., Edmonton.

INDEPENDENT PIPE LINE CO. (Home Oil Co.), Calgary.
Project: 1,073 miles of 36-in. from Edmonton, Alta., to Superior, Wis.; 946 miles of 34-in. from Superior to Montreal, Que.; 72 miles of 16-in. and 74 miles of 10-in. feeder lines from Calgary to Bellshill Lake, Alta.
Status: Proposed.

MATADOR PIPE LINE CORP., Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Proposed. (See U. S.)

MID-CONTINENT PIPE LINES, LTD., Edmonton, Alta.
Project: 1,500 miles of 30-in. from Edmonton to Chicago. U. S. section to be owned by International Oil Pipeline Corp., New York City.
Status: Pending Canadian Board of Transport Commission approval. W. C. Gilman & Co., New York City, has made preliminary study.

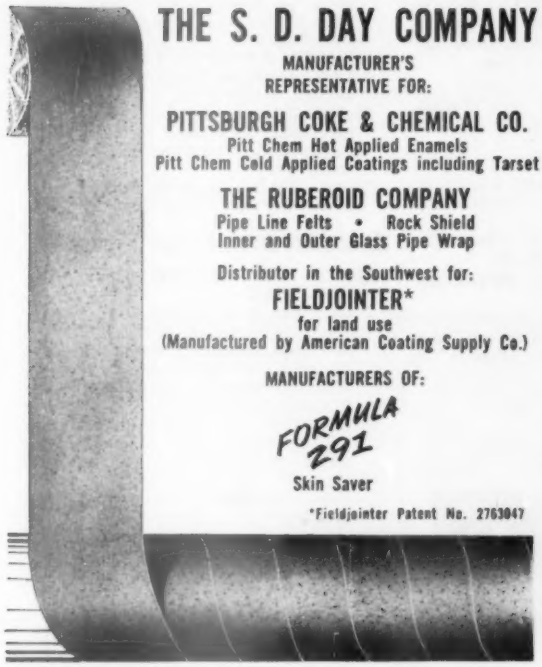
NORTHERN PIPE LINE CO., 30 Broad St., New York 4, N. Y.
Project: 153-mile 16-in. line from Regina, Sask., to Clearbrook, Minn.
Status: Pending National Energy Board approval.

PEACE RIVER OIL PIPE LINE CO., LTD., Calgary, Alta.
Project: 233 miles of 8-in. from the Milligan Creek area of British Columbia to Trans Mountain Pipe Line in Alberta.
Completion: Possibly in the fall 1960.
Project: 8 miles of 6-in., 45 miles of 8-in., and 17 miles of 12-in. from its Fox Creek Pump Station to Windfall, Virginia Hills, and Swan Hills fields in Alberta.
Status: Approved.

PEMBINA PIPE LINE, LTD., Drayton Valley, Alta.
Project: 70 miles of 3 to 10-in. gathering lines in Pembina field.
Contractor: Mannix Co., Ltd., Calgary.
Completion: December 15, 1960.

RANGELAND PIPE LINE CO., Calgary.
Project: 111-mile line from Cessford field to Calgary.
Status: Pending approval of Alberta government.

TRANS-PRAIRIE PIPELINES, LTD., Edmonton.



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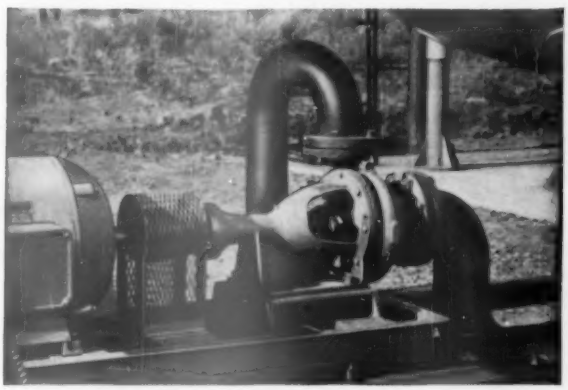

SALT WATER CAN'T DAMAGE THIS CENTRIFUGAL PUMP!

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Doubly protected against severe erosion and corrosion: *(1) Wear rings* save the casing; *(2) Shaft sleeves* eliminate worn shafts. Repair and maintenance cost less.

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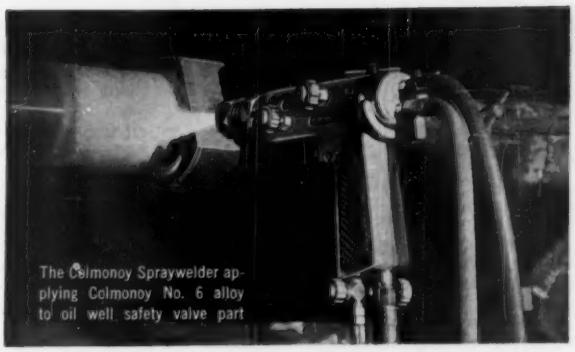
AMPCO METAL, INC. P-48
SPT. 169F, MILWAUKEE 46, WIS.
WEST COAST PLANT: BURBANK, CALIFORNIA
SOUTHWEST PLANT: GARLAND (DALLAS COUNTY), TEXAS

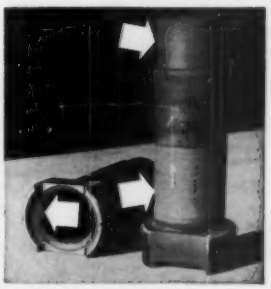


Colmonoy Hard-Surfaced Oil Field Parts Last Longer

Here are two success stories involving fast-wearing oil field equipment. In both cases longer part life was gained by using Colmonoy No. 6. This nickel-base alloy was applied with the Spraywelder, making smooth, welded overlays that resist abrasion and corrosion, have a low coefficient of friction, and do not gall.

Item 1: Oil Well Safety Valves

Safety valves placed down in the tubing strings of underwater oil wells *must* function if the string is broken. One valve manufacturer depends on Colmonoy No. 6 to provide long-wearing, non-galling hard surfaces in the sliding contact areas and on ball seats. Photo shows hard-surfaced areas.



Item 2: Sucker Rod Couplings

Sucker rod couplings working in hydrogen sulfide, salt water, and sand last 6 to 10 times longer when entirely hard-surfaced with Colmonoy No. 6. A west coast shop is doing this for less than one dollar a coupling. Where corrosion is not a problem, only banding at each end need be done.

Item 3: This success story hasn't been written yet. It involves your problem part. Tell us about it. Ask for the Spraywelder Catalog and Hard-Surfacing Manual No. 79.

HARD-SURFACING AND BRAZING ALLOYS

WALL COLMONOY
CORPORATION
19345 John R Street • Detroit 3, Michigan

BIRMINGHAM • BUFFALO • CHICAGO • HOUSTON • LOS ANGELES
MORRISVILLE, PA. • NEW YORK • PITTSBURGH • MONTREAL • GREAT BRITAIN

PIPELINE CONSTRUCTION

Project: 6-8-in. line from Weyburn field to Regina and Moose Jaw, Sask.
Status: Proposed.

Canadian Products Pipelines

BRITAMOIL PIPE LINE CO., LTD., Box 130, Calgary, Alta.
Project: 126-mile line from Pincher Creek to Calgary.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.
Project: 64-mile line from Dick Lake to Edmonton, Alta.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.

FOOTHILLS PRODUCTS PIPE LINE LTD., (Pembina Pipe Line Co., Mannix Co., Ltd.), Calgary, Alta.
Project: 1,300 miles of 16-in. from Alberta to the Great Lakes area.
Status: Proposed.

HUGHENDEN PIPELINE (c/o British American Oil Co., Ltd., 800 Bay St., Toronto).
Project: 125 miles from Dick Lake gasoline plant to underground storage in the Hughenden region of eastern Alberta.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

PROVINCIAL PRODUCTS PIPELINES, LTD.
★ Project: 700 miles of 3½ to 16-in. line to pick up propane, butane, and condensates from natural-gas plants in Alberta for delivery to refineries and other plants.
Status: Proposed.

WESTALTA PRODUCTS PIPELINE, LTD., (Pembina Pipe Line, Ltd., Edmonton, Alta.).
Project: Gathering system to take natural-gas liquids from plants in Alberta for delivery to proposed trunkline to Great Lakes area.
Status: Pending approval of Alberta Board of Public Utility Commissioners.

Canadian Natural Gas Pipelines

ALBERTA GAS TRUNK LINE CO., LTD., Calgary.
Project: 256 miles of 36-in., 75 miles of 30-in., 55 miles of 26-in., 199 miles of various diameter gathering lines, and 42 miles of 16-in. delivery lateral. Main line is from Berland River, Alta., to Crows Nest Pass.
Status: Approved by the Alberta and Canadian governments. Has FPC examiner's approval.
Project: 72 miles of 24-in., 10 miles of 12-in., 24 miles of 6-in., and 2 miles of 4-in.
Contractor: Bannister Construction Co., Edmonton, has contract for 72-mile 24-in. main-line extension from Torrington to Rimbey, Alta.
Completion: 1960.

ALBERTA NATURAL GAS CO., LTD. (Pacific Gas & Electric Co., San Francisco, and Westcoast Transmission, Calgary).
Project: 108 miles of 36-in. across southeastern British Columbia to U. S. border near Kingsgate, B. C.
Status: Has Canadian and FPC examiner's approval.

BRITISH COLUMBIA ELECTRIC CO., Vancouver.
Project: 35 miles of 30-in. from Huntington, B. C., to Vancouver.
Completion: 1960.

CANADIAN INDUSTRIAL GAS, LTD. (formerly Ajax Petroleums, Ltd.), Derrick Building, Calgary, Alta.
Project: 28 miles of 10-in. and 4 miles of 8-in. from Morinville to Westlock Viking Sand field.
Status: Planned.
Completion: By September 1961.

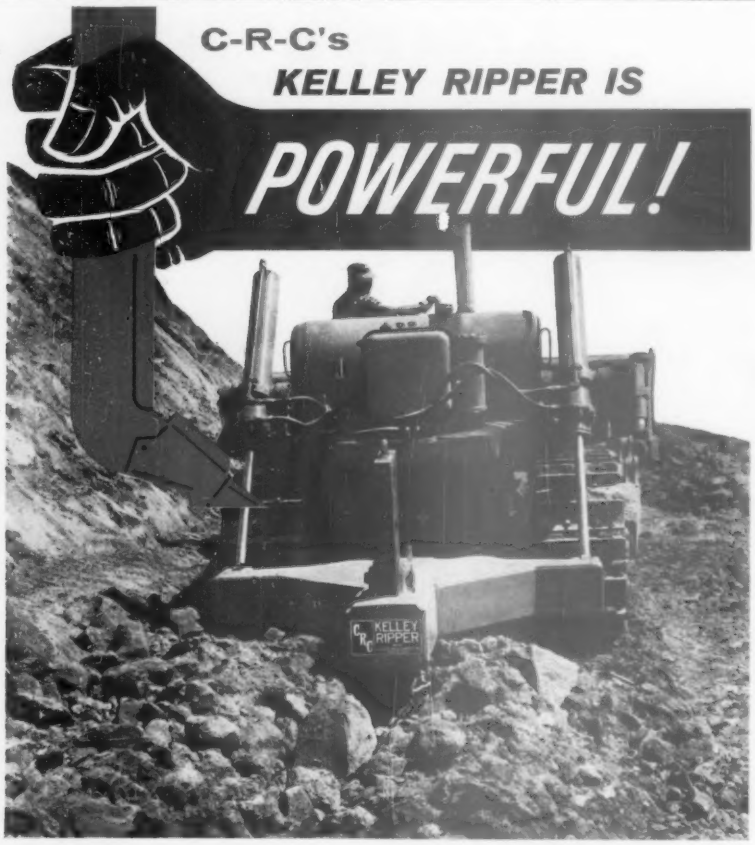
CARTIER GAS CORP. (St. Maurice Gas, Inc. and Consumers' Gas Co., Toronto).
Project: 170 miles from Montreal to Quebec City.
Status: Proposed.

GAS TRUNK LINE OF BRITISH COLUMBIA, LTD., Pacific Bldg., Calgary.
★ Project: 250-mile, 30-in. extension of Westcoast Transmission system from Taylor, B. C., to Fort Nelson.
Status: Planned.
Completion: Late 1961.

MAGNA PIPELINE CO., LTD., Nanaimo, Vancouver Island, B. C.
Project: 25 miles of 4.85-in. double flexible plastic pipe from Huntington, B. C., to Vancouver Island.
Status: Approved by British Columbia Public Utilities Commission. Tentative timetable calls for work to start by spring 1961.

NORTHERN ALBERTA PIPE LINES, LTD., Edmonton, Alta.
Project: 110-mile trunk line, plus gathering system, from Lac La Biche, in McMurray vicinity, to Edmonton.
Status: Pending provincial approval.

NORTHERN NATURAL GAS CO., Omaha.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek, Alta.



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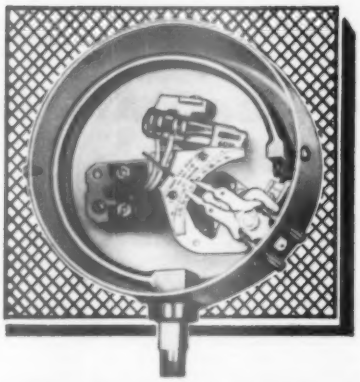

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316 stainless steel welded Bourdon tube. ¼" (316) stainless steel pressure connection. Nickel plated mechanism. Outside adjustments. Calibrated dial. Hermetically sealed mercury contact.

Operating ranges: 30" vac.-75 psig; 10-100 psig; 30-400 psig; 75-800 psig. and 100-1000 psig.—with varying differentials and electrical capacity to meet your application.

Three case styles: General Purpose NEMA 1; Weather-Proof NEMA 1A, 2, 3, 4; Explosion-Proof Class 1 Group C, & D; Class 2 Group E, F, G, NEMA 7, 9, 9A.

WRITE FOR BULLETIN 619

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

PIPELINE CONSTRUCTION

Status: Planned.

Project: 32 miles of 24-in. from Pincher Creek to Montana border to tie in with planned U. S. line on to Minneapolis.

Status: Planned.

QUEBEC GAS TRANSMISSION LINES, INC., 1610 Sherbrooke St. W., Montreal.

Project: 300-mile line from Montreal to Quebec City.

Status: Proposed.

SASKATCHEWAN POWER CORP., 1739 Cornwall St., Regina, Sask.

Project: 179 miles of 4, 6, and 8-in., in addition to distribution lines and laterals.

Completion: 1960.

TRANS-CANADA PIPE LINES, LTD., Toronto.

Project: 74 miles of 34-in. main-line loop (Burstall to Winnipeg, Man.) and 51-mile 30-in. lateral from Emerson, Man., to U. S. border near Noyes, Minn., to connect with proposed Midwestern system now before U. S. FPC.

Status: To start spring 1960.

Completion: Fall 1960.

Project: An additional 390 miles of 34-in. main-line loop between Burstall and Winnipeg, Man.

Status: Planned. About 268 miles scheduled for construction in 1961, and 122 miles in 1962.

VAN TOR OIL & EXPLORATION CO., Vancouver, B. C.

Project: Line from British Columbia mainland to Vancouver Island.

WESTCOAST TRANSMISSION CO. LTD., Calgary.

Project: (See Alberta Natural Gas Co., Ltd., for joint project).

Foreign Crude Oil Pipelines

ABU DHABIE MARINE AREAS, LTD. (partly owned by British Petroleum Co., Britannic House, Finsbury Circus, London E.C. 2).

Project: 20 miles from offshore Persian Gulf pool to Das Island.

Completion: 1962.

ARAB PIPELINE.

Project: 1,250-mile pipeline from the Persian Gulf to Mediterranean.

Status: Proposed by Saudi Arabian Government and approved by the Arab League's petroleum department.

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.

Project: 73 miles of 30-in. loop on Safaniya-Ras Tanura line.

Status: Under way.

Contractor: Company personnel.

Completion: October 1960.

Project: 18 miles of 34 and 36-in. from Qatif to Ras Tanura.

Status: Under way.

Contractor: Company personnel.

Completion: Third quarter 1960.

BARNABO GROUP (Italian interests).

Project: A line from Venice, Italy, to Innsbruck, Austria, which could then be extended to Munich, Germany.

BASRAH PETROLEUM CO.

Project: 65 miles of 30 and 32-in. from Zubair to Fao in southern Iraq.

Contractor: Turriff-Burden, Ltd., Tulsa.

Completion: 1961.

BOLIVIA-PARAGUAY.

Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.

Status: Planned.

CIE. DES TRANSPORTS PAR PIPE-LINES AU SAHARA (subsidiary of

FLEET-LINE

WELDING FITTINGS

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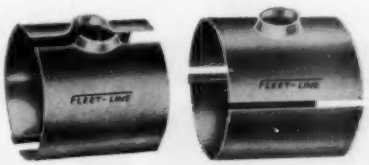
REDUCERS: Concentric and eccentric. Nominal pipe sizes 1" to 30", ASA B16.9, ASTM A234. Schedules 10 to 160, stainless steel, and other alloys. Special lengths and sizes.

SADDLES: Conventional, and for pressure vessel heads. Nozzle sizes from ¼" to 24". Fleet-Line saddles weld neatly into place in much less time, and with much less welding rod.

Full encirclement saddles.



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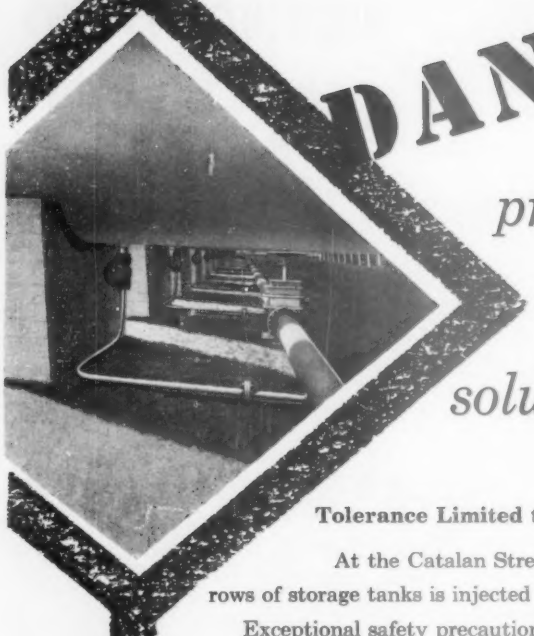

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problem: **FIELD WELDING NOT PERMITTED!**

solution: **SHOP FABRICATION BY MIDWEST!**

Tolerance Limited to 1/16" on Inlets to 500-Ft. Header.

At the Catalan Street Station of Laclede Gas Company, St. Louis, propane from rows of storage tanks is injected into the natural gas supplied to Laclede customers. Exceptional safety precautions precluded field fabrication and welding on piping to connect natural gas lines and the propane tanks.

Instead, Midwest shop-fabricated the propane headers in lengths up to 70 feet, complete with nozzles and tank outlet piping for flanged connection to each tank. These connecting lines had to be - and were - accurate in alignment within a tolerance of 1/16".

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PIPELINE CONSTRUCTION

Cie. de Recherches et d'Exploitation de Petrole au Sahara), Paris.
Project: 420 miles of 24-in. from Edjele fields in Sahara to the Tunisian Mediterranean Coast.
Contractors: Groupement des Societes Entrepose et Parisienne pour l'Industrie Electrique en vue de l'Etude et de la Construction de Pipe-Lines, and Ste. des Grands Travaux de Marseille. Engineering firm on the job is Bechtel Mediterraneenne S. A.
Completion: October 1960.

CREOLE PETROLEUM CORP., Caracas.
Project: About 14 miles of 8 to 24-in. gathering line in Lake Maracaibo.
Status: Under way.
Completion: December 1960.

EASTERN BLOCK COUNCIL FOR MUTUAL ECONOMIC AID.
Project: 2,500-mile "Vomecon" pipeline from the Volga-Ural oil fields in Russia to East Europe satillites.
Status: Construction under way in Czechoslovakia, with completion of this section by early 1961.

ELBURZ OIL CORP.
Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.
Status: Proposed.

ENI (Italian state oil agency) and **ITALO-SWISS FINANCE CO.**
Project: A 700-mile system from Genoa to Aigle, Switzerland, thence northeast to the German border, where it would split with one branch going to Munich and another branch to the Karlsruhe area. Feeder lines would go to Turin, Milan, and Cremona, Italy.
Status: The trunk line from Genoa to Aigle approved by the Italian Government.

ESSO STANDARD (LIBYA), INC.
Project: 100 miles of 30-in. from Zelten field to Gulf of Sirte.
Status: Bids invited.

IRANIAN OIL PARTICIPANTS, LTD.
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bander Mashur line.
Status: Planned.

IRAQ PETROLEUM CO., LTD., 214 Oxford Street, London, W. 1.
Project: 44 miles of 32-in. in Iraq, 21 miles of 24-in. in Syria towards Banias, and 38 miles of 30-in. in Syria and Lebanon toward Tripoli.
Status: Under way.
Contractor: Turriff-Burden, Ltd., Tulsa.

OASIS OIL CO. OF LIBYA, 539 South Main Street, Findlay, Ohio.
Project: 100 miles from Dahra field in Libya to Mediterranean Coast.
Status: Bids invited.

OIL INDIA PRIVATE LTD. (Burmah Oil Co. and Assam Oil Co., two-thirds, and India Government one-third).
Project: 720 miles of line in northeast India. This would include 260 miles of 16-in. from Nahorkatiya to Noonmati and 460 miles of 14-in. from Noonmati to Barauni.
Contractors: Mannesmann, a German firm, will lay the 260-mile 16-in. system. Contract for the 460-mile 14-in. line has been awarded to an Italian Government company.
Completion: The 16-in. system is scheduled for completion in March 1961.

PETROLEO BRASILEIRO S. A. (Brazil).
Project: 250-mile line from Rio de Janeiro to Belo Horizonte refinery site.
Status: Petrobras will invite bidding from companies who have submitted tenders.
Project: 35 miles of 8-to 12-in. pipe from Buracica to Candeia.
Contractor: Techint, Inc., Milan, Italy.
Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.
Status: Planned.

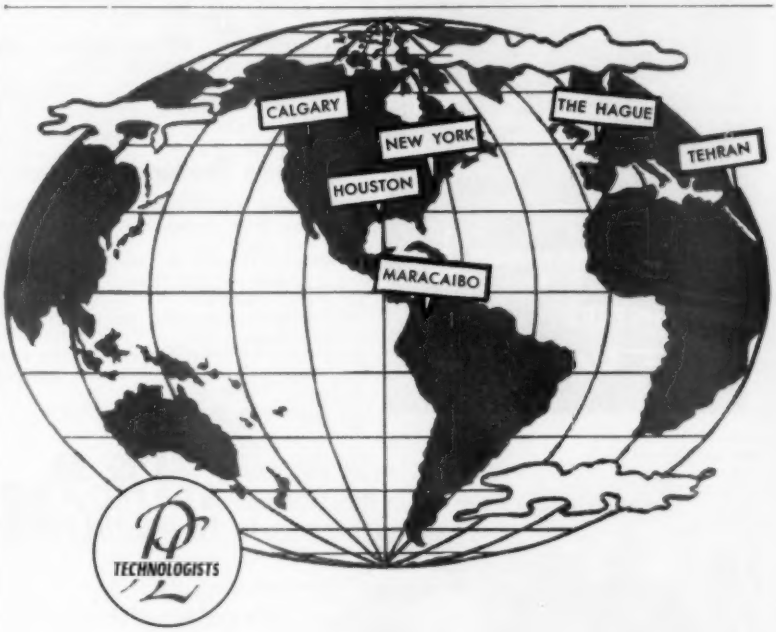
ROYAL DUTCH-SHELL.
Project: 12-mile line from Gore Bay, Australia, to Royal Dutch-Shell's Clyde refinery.
Status: Planned.
Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Borneo.
Status: Planned.
Contractor: Williams Brothers Overseas, Ltd., Tulsa, and John Brown, Ltd., London.
Completion: January 1, 1962.

SHELL-BP PETROLEUM DEVELOPMENT CO. OF NIGERIA, LTD., 38/39 Marina, Lagos, Nigeria.
Project: 18 miles of 12-in. line from Port Harcourt to Bonny, Nigeria.
Status: Under way.
Constructor: African Construction Co.

SOUTH EUROPEAN PIPELINE CO. (Jersey Standard, Caltex, Shell, British Petroleum, and 12 other firms.)
Project: 419 mile 30-in. line from Lavera, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany.
Status: Construction to get under way by January 1961.
Completion: 1962.

SUPERIOR OIL CO., Los Angeles.
Project: A 16 and 24-in. line from its Lake Maracaibo, Venezuela, production to shore.
Status: Planned.
Contractor: Pipe Line Technologists, C.A., Maracaibo, has design.

SYRIAN PIPELINE, Damascus.



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Pipe Line Technologists, Inc. provides specialized professional engineering for every phase of oil, gas, chemical and products pipe line operation, from the initial market analysis and feasibility reports to the design, engineering, financial planning, supervision of construction and management of the completed project. The findings of these experienced, qualified specialists in their field are coordinated by group action into conclusive reports and efficiently built and operated pipe lines.

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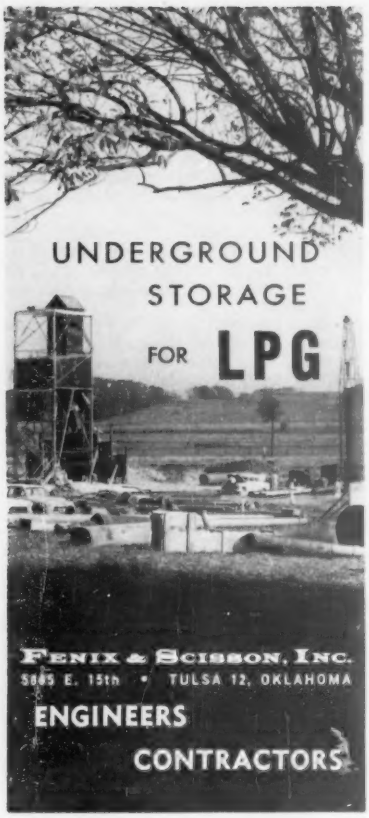

PIPELINE CONSTRUCTION

Project: 500-mile line from Karshuk field, Syria, to Mediterranean.
Status: Proposed.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
(See Eastern Block for information on new East Europe line).

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blancha.
Status: Bids requested.
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS, La Paz.
Project: 407-mile 12-in. line from Camiri to Sica Sica.
Status: Planned.

Foreign Products Pipelines

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 37 miles of 8-in. LPG line from Abqaik to 'Ain Dar.
Status: Planned.
Contractor: Company personnel.
Completion: 1961.
Project: 6½ miles of 6-in. LPG line from Ras Tanura refinery to the terminal.
Status: Under way.
Completion: Fourth quarter 1960.

ESSO PETROLEUM CO., LTD., 36 Queen Anne's Gate, Westminster, London, S.W. 1.
Project: 70-mile ethylene line from the Fawley refinery to Severnside.
Status: Planned.

ESTRADA FERROVIARIA SANTOS A JUNDIAL, Sao Paulo, Brazil.
Project: 25 miles of 6-in. ethylene line from Cubatao to Rio Grande.
Status: Pending approval.
Contractor: Techint, Inc., Milan, Italy.

NATIONAL IRANIAN OIL CO., Teheran.
Project: 510 miles of 8-in. from Teheran to Meshed, Iran.
Status: Under way.
Contractor: Williams Brothers, Tulsa, has contract for about half this project.

NORTH ATLANTIC TREATY ORGANIZATION (Bid details from Bureau of Foreign Commerce, U. S. Department of Commerce, Washington).
Project: 57 miles of 8-in. in Germany to Land Baden-Wuerttemberg air field.
Status: Planned.
Project: 93 miles of 6-in. in Turkey.

PETROLEOS MEXICANOS.
Project: 291 miles of 8-in. from Torreon to Chihuahua.
Status: Planned.
Completion: March 1961.

PIPELINES OF PUERTO RICO, San Juan.
Project: 95 miles 8-in. from Penuelas to Catano.
Status: Approved by Puerto Rican Public Service Commission.

SYRIAN PIPELINE.
Project: About 310 miles from Homs to tank farms in the Damascus, Aleppo, and Latakia areas.
Status: Bidding deadline past.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 29-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
Project: 700 miles from Novo-Kuibyshev refinery to Bryansk.
Status: Under way.

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

PAT. APPLIED FOR

"BEVEL-LAND" GRINDER
. . . smooths pipe cuts and places the lands on bevels in a matter of seconds.

PATENT NO. 2,869,293

H & M STANDARD MACHINES

Save Manhours . . .
Increase Profits

H & M Standard Machines give accurate, dependable pipe cutting and beveling results cut after cut . . . in the field or in the shop. The seven models of H & M Machines are designed to handle all sizes of pipe from 1½" - 36". H & M's are lightweight, easy to handle . . . and are built to withstand the toughest operating conditions. WRITE FOR A CATALOG ON THE COMPLETE H & M LINE, TODAY!

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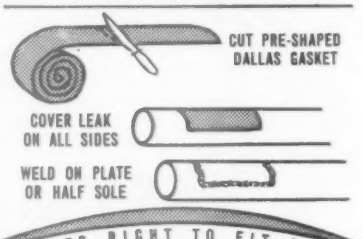
A FAST PIPELINE REPAIR!
LASTS LONGER THAN NEW CASING!



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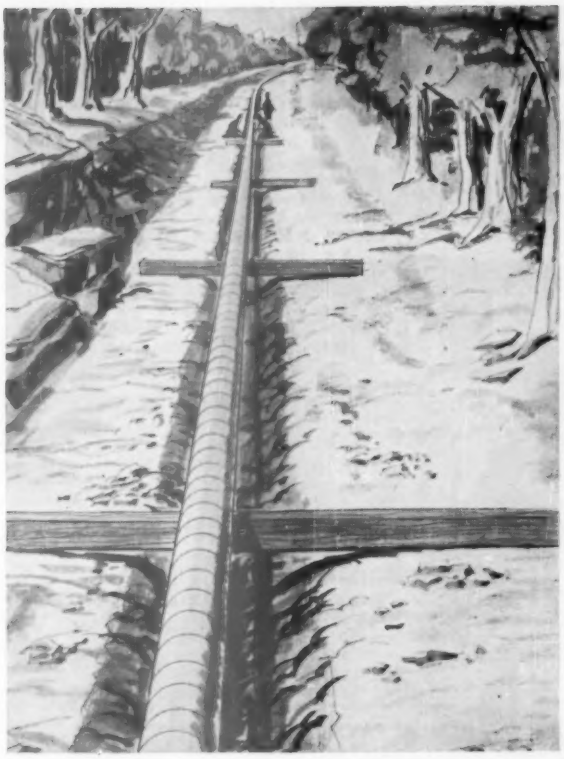

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provide more positive cathodic protection for all types of structures

Duriron performs as well as graphite in all the easy services, and far outperforms graphite when the going gets tough in marshlands, at river crossings, or wherever it is impractical to use backfill.

Durco high silicon cast irons are resistant to sea, brackish and fresh waters as well as all soil environments.

Duriron Anodes have unexcelled corrosion resistance, good electrical properties, and they are easy to install. For real protection, get Duriron. Write for Bulletin DA/6.

STANDARD DURIRON ANODE SIZES

Type Anode	Size	Area Sq. Ft.	Weight (Lbs.)	General Application
B	1" x 60"	1.4	14	Fresh Water
C*	1½" x 60"	2.0	25	Ground Bed
D	2" x 60"	2.6	46	Ground Bed
E	3" x 60"	4.0	115	Salt Water
G	2" x 9"	0.4	5	Ducts
J	3" x 36"	2.5	80	Salt Water
M	2" x 60"	2.8	57	Salt Water

*Applicable also in fresh water service. Should not be used in ground beds without backfill.

THE DURIRON COMPANY, INC.
DAYTON, OHIO

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

AMERCOAT: COMPLETE CORROSION PROTECTION

No one coating is ideal for all applications. A coating which gives outstanding protection against chemical fumes in a refinery may fail completely when exposed to salt water splash, high humidity or hot sun on an offshore rig in the Gulf area.

In order to provide complete corrosion protection, the Amercoat Corporation manufactures more than 40 completely different products, each formulated to give maximum corrosion protection for specific applications. As new processes and techniques alter exposures and requirements, Amercoat's continuing research develops new products to meet those requirements. Also, advanced research and testing upgrades and improves existing products to maintain maximum protection and enduring, maintenance-free life. Amercoat protective coatings, ranging from vinyls to epoxies to phenolics, are tailor-made for long-range protection and economy in tough applications.

DIMETCOTE—a 100% inorganic, zinc silicate coating for severe weather exposure, salt water spray, fresh water, etc.
Typical applications: Offshore rigs, floating roof tanks, steel structures, pipelines, cooling tower piping, etc., and as a permanent primer.

AMERCOAT No. 33—A vinyl maintenance coating unexcelled for water immersion, chemical spillage or corrosive fumes.
Typical applications: Tank exteriors, pipelines, etc.

AMERCOAT No. 78—A catalyzed coal tar epoxy for exceptional resistance to severe chemical exposures.
Typical applications: Sour crude storage tanks, pipelines

BONDSTRAND—A corrosion resistant, high strength glass reinforced epoxy pipe.
Typical applications: Gathering lines, cooling lines, tanker loading lines, oil and gas lines.

Technical data available on request. Write to:

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South Gate, California

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2404 Dennis St. Jacksonville, Fla.
6530 Supply Row Houston, Tex.
111 Colgate Buffalo, N.Y.

PIPELINE CONSTRUCTION

Foreign Natural Gas Pipelines

CREOLE PETROLEUM CORP., Caracas.
Project: 18 miles of 30-in. and about 13 miles of 8 to 24-in. from stations in Bachaquero area to the Bachaquero compressor plant.
Status: Under way.
Completion: October 1960.

GASES NATURALES DE COLOMBIA, S.A. (Owned 50% by Colombian Petroleum Co., which is affiliated with Mobil International and Texaco, and 50% by local interest.)
Project: 140 miles of 10-in. from Cicuco field to the Caribbean port of Barranquilla.
Completion: Late 1961.
Project: 75 miles from Rosh-Zohar field to Ashdod Yam.
Status: Proposed.

IRAQ GOVERNMENT.
Project: A natural-gas line from Rumaila oil field to Basrah.

MENE GRANDE OIL CO., Caracas.
Project: 19 miles of 12-in. from East Soto to Zapatos.
Completion: 1960.

PAKISTAN INDUSTRIAL DEVELOPMENT CORP.
★ Project: Further extension of the Sui-Multan system into northern West Pakistan.
Status: Under consideration. Technical survey has been ordered.

PAKISTAN PETROLEUM CO.
Project: 145 miles of 8-in. from Sylhet field to Daccq, East Pakistan.
Status: Proposed.

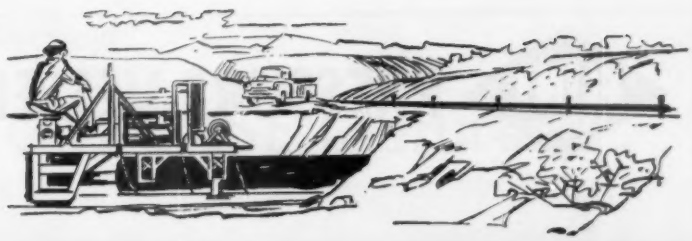
PETROLEOS MEXICANOS.
Project: 483 miles of 24-in. from Jose Colomo field in State of Tabasco to Mexico City.
Status: Under way.
Contractors: Condusa is contractor. Contracts for eight river crossings awarded to Collins Construction Co., Port Lavaca, Tex., and Constructora Inde S. A. de C. V., Mexico City.
Completion: November 1960.
Project: 200 miles of 14-in. from Mexico City to Salamanca.
Status: Planned.
Completion: September 1961.
Project: 291 miles of 12-in. from Torreon to Chihuahua.
Status: Planned.
Completion: March 1961.

SN REPAL.
Project: A 327-mile system from Hassi R'Mel gas field in Algeria, to the Mediterranean. Trunk will be 24-in. with a 20-in. branch to Oran and 16-in. branch to Algiers.
Contractor: Groupement Entrepose-Ste. Parisienne pour l'Industrie Electrique (GREP) has contract for 200 miles from Hassi R'Mel to Tiaret.
Status: Under way.
Completion: Spring 1961.

SOC. SICILIANA METANADOTTI (SOSIM). Partners include Edison Power, Italcementi, Fiat Motor, Sicilian SGES Power, Bombrini Parodi Delfino Chemical, and Montecatini.
★ Project: 560 miles from Hassi R'Mel gas field, Algeria, to Cape Bon, Tunisia, 77 miles across the Sicilian Channel, and a route well into northern Italy which would run less than 1,000 miles farther.
Status: Engineering studies under way.

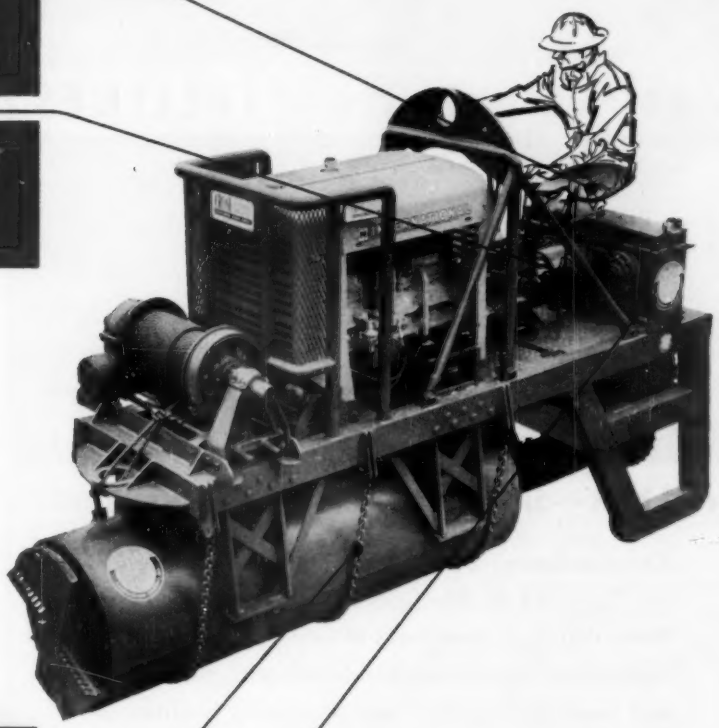
STANDARD-VACUUM OIL CO., New York.
Project: 60 miles of 8-in. from Radja

CROSE



NEW ROAD BORING MACHINE

FIELD-TESTED
TOP PERFORMANCE



The new Crose Road Boring Machine provides the fastest, simplest, most economical way for boring crossings and installing casings up to and including 42" in diameter. Heavy duty torque converter and reverse-o-matic transmission deliver full, constant speed and smooth power flow . . . let you switch auger from forward to reverse without engine slowdown . . . no gear shifting.

The smaller Model RBA Crose Road Boring Machine is still available for casing up to 24".

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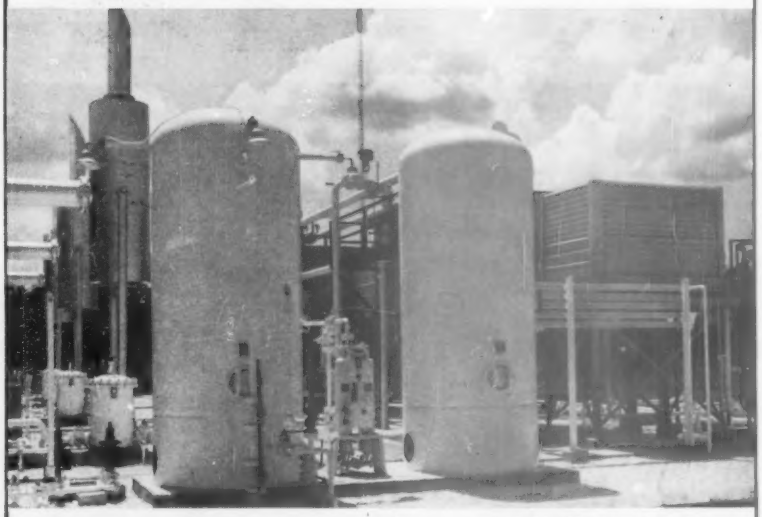
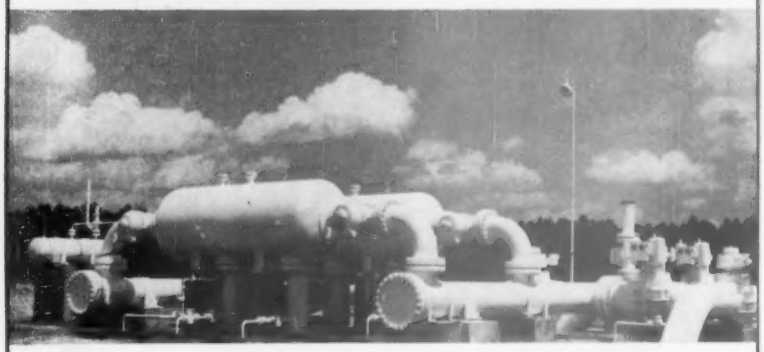
FLINT STEEL

PRESSURE VESSELS



Dot America's PIPELINES



Scrubbers—Snubbers—Air Tanks—Drip Tanks

These and many other processing and storage units for Natural Gas Pipelines are fabricated by Flint. More than forty-five years of heavy and light plate fabrication experience, combined with the largest and most modern plate manufacturing facilities in the Southwest enables Flint to fabricate to specifications on time.

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STEEL PLATE FABRICATORS ASSOCIATION

PIPELINE CONSTRUCTION

field to Palembang, Sumatra.
Status: Planned.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: Two parallel, 40-in. lines, each over 1,300 miles long, from Gazli, near Bukhara, northward to Sverdlovsk and Chelyabinsk.
Status: Planned.
Project: Line from Samarkand through Tashkent to Chimkent, Dzhambul, Frunze and Alma-Ata near Chinese border.
Completion: Line from Samarkand to Tashkent expected to be finished in 1960. Completion of rest of line expected by 1965.
Project: Line from Berezovo field southward to Sverdlovsk.
Status: Proposed.
Project: 438 miles from Dashava in Carpathian Mountains to Minsk.
Status: Under way.
Completion: 1960.
Project: Line from Minsk northward to Baltic Sea area.
Completion: To Vilnius, Lithuania, in 1961; to Riga, Latvia, in 1962.
Project: Line from Minsk northeast to Leningrad.
Status: Proposed.
Project: 405 miles from Saratov north to Gorki via Penza.
Status: Under way.
Completion: 1960.
Project: 800-mile, 32-in. loop of existing line from Stavropol fields in northern Caucasus to Moscow.
Status: Under way.
Completion: 1960.
Project: 800-mile, 40-in. line from Krasnodar fields north of Caucasus Mountains to Serpukhov, south of Moscow, via Rostov and Lugansk.
Status: Under way.
Project: 310-miles of 32-in. line ringing Moscow at radius of about 50 miles.
Status: Under way.
Completion: 1962.

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: Line from Comodoro Rivadavia to Buenos Aires with a spur to Plaza Huincul field in Neuquen province. Line will be 26 in. to the connecting point for the Plaza Huincul link and 30 in. from the connection to Buenos Aires.

Canada Approves Gas Export

The second bid of Niagara Gas Transmission Co. to export 73½ billion cubic feet of gas to New York has been approved by the Canadian Government.

The National Energy Board on April 1 rejected the application of Niagara, a subsidiary of Consumers Gas Co., Toronto. The board said the original defect—"inadequate" sale price of the gas—has been corrected. Niagara is to receive a higher price which St. Lawrence Gas Co., the importer, will absorb.

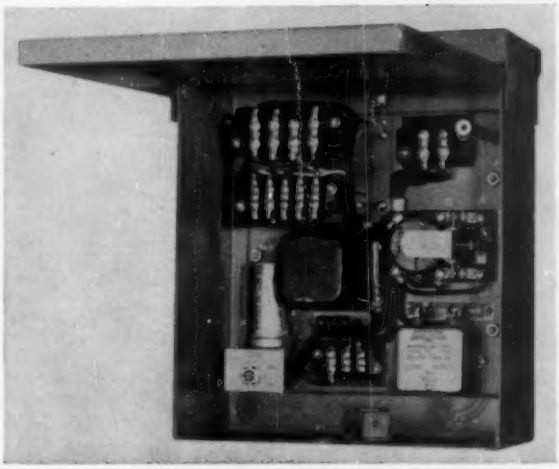
St. Lawrence earlier received a Federal Power Commission examiner's approval to import up to 16,710,000 cu. ft. daily to serve the Massena-Ogdensburg area of New York.

▶ ▶ ▶ New Equipment Section

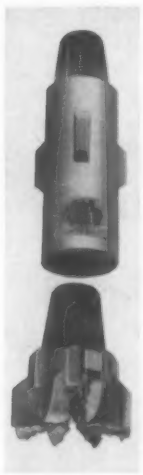
This week's SHOWCASE features . . .

Oil-well pumpoff control

. . . recently announced automatically and accurately stops an oil-well lift pump whenever a well pumps off, the maker claims. It thus promises to reduce pumping time, increase equipment life, and maintain maximum production over a wide range of varying field conditions. Pumpoff is detected by monitoring the rate of flow with an electrically self-heated thermistor probe. The pulsating flow of fluid, delivered with each stroke of the reciprocating pump, gives rise to voltage pulsations across the thermistor. Upon pumpoff, the fluid flow diminishes with a corresponding reduction in the signal occurring. This drop in signal amplitude causes the transistor-controlled relay to operate to stop the pump. Source: **Cutler-Hammer, Inc., 315 North Twelfth, Milwaukee 1.**



Bit mills

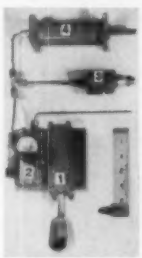


. . . production packers, bridge plugs, and cement using tubing as the drilling string. The packer bit will drill production packers in 3 or 4 hours, retaining plugs in 1 hour, and cement up to 20 ft. per hour, the maker claims.

If drill pipe and drill collars are used in the drilling string, production packers can be drilled in 1 to 2 hours, bridge plugs in a few minutes, and cement up to 40 ft. per hour, according to the maker. Two to three packers and a quantity of cement can be drilled with each packer bit.

The bit consists of the bit proper and a protective body. The protective body has a standard range of connections so it may be screwed directly into the bit sub. Source: **A-Z International Tool Co., 5619 Fannin, Houston 4.**

Self-powered safety control



. . . is sensitive to a wide range of temperatures, pressures, or both in combination. The Calcon safety control system can be assembled into compact units to meet many needs. The unit operates through a small captive charge of compressed air and provides immediate, positive action response, the maker claims. It reportedly can sense pressures up to 2,000 psi. Since it has its own source of pneumatic power, it doesn't depend upon outside power which could fail. Source: **California Controls Co., 1525 Powell, Oakland 8.**

●

Polished-rod packing

. . . lasts eight to ten times as long as older types, according to the maker. A semimetallic construction, the Marlo packing forms a dense, shock-absorbing, bearing-like surface, and is designed to eliminate hardening and burning during pump-offs. It is reported to be both resilient and corrosion-resistant. Source: **Axelson Div. of U. S. Industries, Inc., 6160 S. Boyle Ave., Los Angeles 58.**

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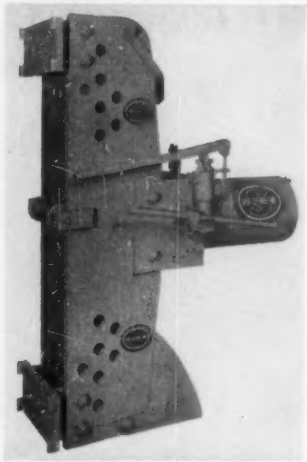
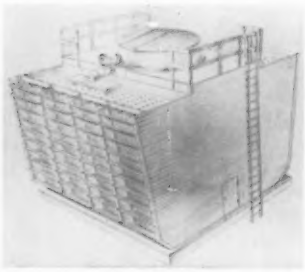
New Equipment



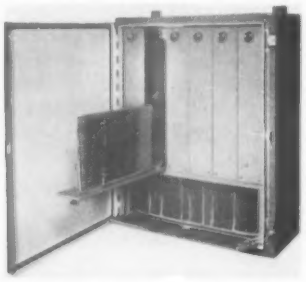
Pipe and kelly

. . . straightener rated at 100 tons may be set vertically on the rotary table to straighten either pipe or kelly, or horizontally, for convenient straightening of pipe. Two quick-disconnects permit use of an independent hydraulic power source or, a hand pump. Supporting rollers may be moved to several positions to provide for various types of bends or kinks, and various sizes of tubular goods. A trailer can be obtained to transport the hydraulic power unit and pipe straightener. Source: **Joe Stine, Inc., Box 14471, Houston 21.**



New series of cooling towers

. . . recently announced extends the capacity of the maker's line to economically meet the water-cooling requirements of industrial processes which do not require capacities in the range of large industrial cooling towers. The Series 15 Double-Flow tower design is said by the maker to combine many of the advanced features of their Double-Flow industrial cross-flow towers. Features of the tower include sloping louver walls, broad louvers, and glass-reinforced polyester filling supports for permanent alignment and positioning of splash bars. Source: **Marley Co., 222 W. Gregory Blvd., Kansas City, Mo.**



Control data

. . . transmitted over long or short distances with this recently developed equipment designed specifically for use by pipeline operators and producers. Monitoring data as well as control data can be transmitted with the equipment. Offered as an off-the-shelf unit, the equipment is primarily fabricated of transistors and similar components. The basic unit is

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BrakeSol®

OIL FIELD CHEMICALS

Developed exclusively for solving particular problems in the petroleum industry.

P.T.C. . . . The original Paraffin Treating Chemical. Holds paraffin in suspension from formation to refinery.
DEMULSIFIER D-7 . . . Universal Treating Compound. Gives cleaner oil with less heat resulting in a BETTER PRICE.
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CORROSION INHIBITOR CI-123 . . . Designed especially for control of oil field corrosion problems.
GYP and SCALE TREATMENT GS-20 . . . Effective on these types of carbonates and sulphates: calcium, strontium, barium and magnesium.

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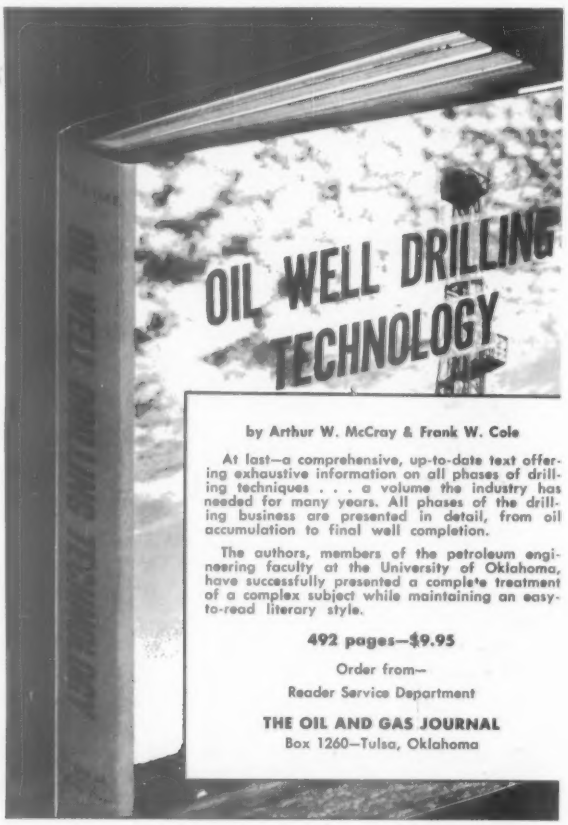

by Arthur W. McCray & Frank W. Cole

At last—a comprehensive, up-to-date text offering exhaustive information on all phases of drilling techniques . . . a volume the industry has needed for many years. All phases of the drilling business are presented in detail, from oil accumulation to final well completion.

The authors, members of the petroleum engineering faculty at the University of Oklahoma, have successfully presented a complete treatment of a complex subject while maintaining an easy-to-read literary style.

492 pages—$9.95

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capable of measuring and transmitting eight variables, such as temperature, pressure, and viscosity. Source: **International Controls Corp., 3110 Eastside, Houston.**

●

Oil metered

. . . at 1,200 psi. with a new BiRotor meter, the Model B-55. The meter is designed to handle crude and refined petroleum products and other liquids. Rated at 120 g.p.m., it is a positive-displacement type particularly suited for small pipelines, ACT units, and similar applications. A companion meter, Model B-54, has the same capacity and a working pressure of 600 psi. Source: **Ralph N. Brodie Co., Alvarado and W. 137th Ave., San Leandro, Calif.**

●

Latest in pipe slings

. . . is this Swing Sling which is designed to solve the problem of lifting pipe without damage. Basically, it consists of parallel aircraft cables covered with rubber grommets secured at the ends by special attachments. The grommets have a wide-bearing rubber exterior to protect pipe against damage to its coating. One sling can handle a variety of lift jobs. Source: **Colorado Fuel & Iron Corp., Continental Oil Bldg., Denver 2.**

●

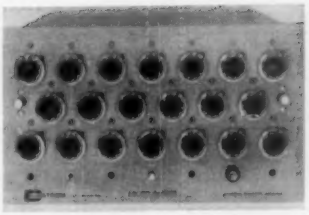
Engines

. . . automatically controlled with a new concept in control systems now available. The control system automatically starts, loads, and shuts down internal-combustion engines. It was developed specifically to meet the requirements of gas-compressing applications. A pneumatically actuated type, the system incorporates safety functions to signal or to shut down the engine due to malfunction of any one of an unlimited number of measurable variables. Source: **Robertshaw-Fulton Controls Co., 911 East Broad, Richmond 19, Va.**

●

New instrument

. . . to monitor voltage at low levels from thermocouples, strain-gage bridges, and other resistance-bridge transducers and for monitoring current in the 1 to 100 micro-amp. range is available for industrial-process control. The unit is based on the maker's device, called Magsense, developed for detection and comparison of low-level signals. Source: **Daystrom, Inc., Control Systems Div., La Jolla, Calif.**



500-MILE CRUDE OIL LINE PROTECTED WITH RECTIFIERS

Here's how one major pipeline company arranged cathodic protection for a 500-mile crude oil line. The line averages about 22 inches in diameter and crosses parts of two midwestern states.

Current requirement surveys were made. Then a rectifier protection system was decided upon.

CSI engineers were awarded the contract on a competitive bid basis. They furnished and installed all necessary materials—rectifiers, poles, graphite rods, coke breeze, wire and electric circuits. The job was finished in less than 30 days.

CSI has power augers, ditching machines and trained personnel to help with your installation problems. CSI also offers expert consultation service and a complete line of cathodic protection materials—including Dow magnesium anodes.

For estimates or quotations on your needs, call or write today.

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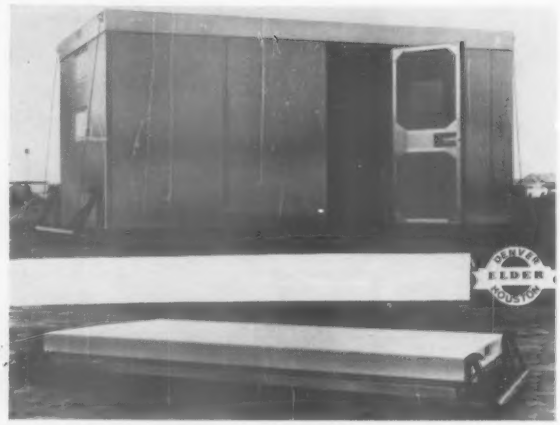
New Equipment

Mobile housing is easy to move

. . . as it knocks down into a compact unit, offering a way to reduce shipping costs by as much as 80% compared to units which must be shipped erected. The unit is erected quickly. The side walls are mounted on continuous hinges and are simply raised into place. The end walls are bolted into the side walls and frame. The glass fiber roof is of one-piece construction. Source: **Elder Trailer & Body, Inc., 4830 Race, Denver.**

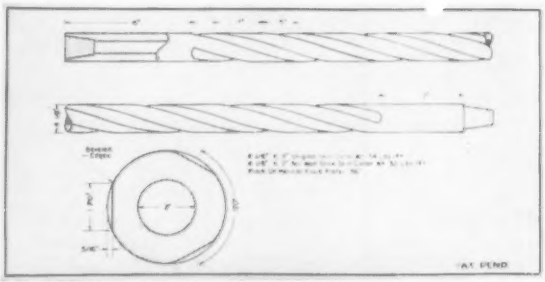


Tubing, casing threaded on job

. . . with a new mobile unit capable of threading to API specifications oil-well tubing and casing through an 8⅝-in. size. Rigup time is only about 1 hour. Powered by a diesel-engine-driven 20-kw. generator, the unit has reversible automatic conveyors that collapse for highway travel. These move the pipe into and out of the threading position. Source: **Atlas Pipe Inc., 511 First City National Bank Bldg., Houston.**

Drill-collar sticking reduced

. . . with a new drill collar now available on a rental basis, called the No-Wall-Stick drill collar. To reduce sticking of the collar string due to differential pressure, the maker has decreased by 40% the total contact area of the drill-collar body and the wall of the bore hole. Drilling-mud hydrostatic pressure is allowed to equalize around the collar body, each foot along its length. The drill collar is available for rental in sizes of 6, 4¾, and 4⅛ in. Source: **Engineering Enterprises, San Jacinto Bldg., Houston.**



Thermoplastic

. . . top-entry valve is a ball type, permits you to perform on-the line maintenance as you can get to the working parts without disconnecting any piping. Simply unscrew the valve bonnet and lift out the molded, one-piece ball and stem and the seat inserts. The valve comes in two materials, unplasticized polyvinyl chloride for temperatures to 150° F. and Penton, a new chlorinated polyether, for hot corrosive service to 250° F., or higher. Available sizes range from ½ through 3 in. Source: **Tube Turns Plastics, Inc., 2929 Magazine, Louisville 11, Ky.**

A BETTER SERVICING BLOCK

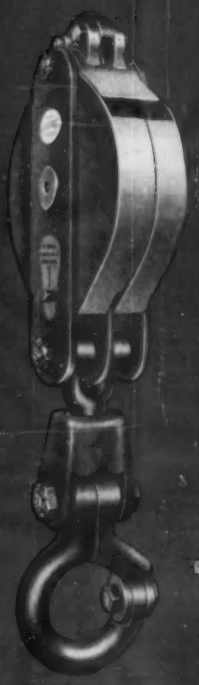
TYPE...

SIZE...

CAPACITY...

for your particular need

14-24" Sheaves
15-100 Tons



10-26" Sheaves
10-100 Tons

14-20" Sheaves
15-75 Tons

The most complete range of oil field servicing blocks available, all embodying the Superior McKissick features—Your assurance of long, dependable service—

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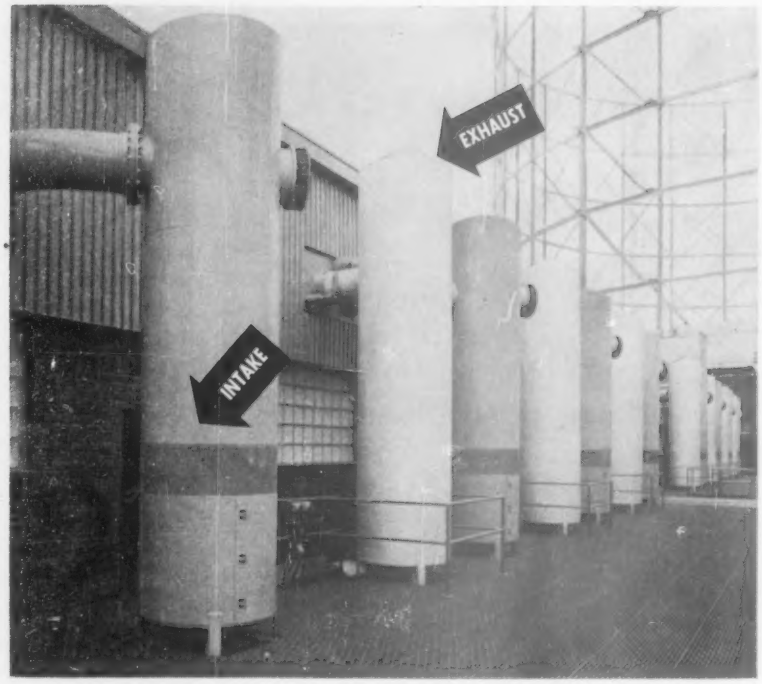

For remote- or engine-mounted turbochargers

SILENT TWINS Increase Operating Efficiency... Provide Clean, Filtered Air Intake and Optimum Exhaust Silencing

Burgess-Manning Silent Twins, matched units for remote- or engine-mounted turbochargers, provide clean, filtered intake air at minimum pressure drop and optimum silencing efficiency on both sides of the system. Silent Twins are available for vertical or horizontal installation, and afford flow-conditioned, compact piping for best operating efficiency of either proposed turbocharged engines or turbocharging of existing engines.

Silent Twins can be furnished with either of two types of filters — depending upon the dust load. One is petrolatum-treated hogshair, extensively used in the Gulf Coast area, the Eastern United States, and other light dust load areas. For the Western United States and in areas where heavy dust is a factor, we recommend a special felt material that will load up and hold dust and dirt of a very small micron size without carrying over to the engine. Both types have proved to be the best-accepted, lowest-cost, and lowest-maintenance filters available. The filters are contained in a compact cartridge which is easily installed and removed through large access doors in the filter chamber.

Burgess-Manning intake and exhaust silencers are scientifically engineered to prevent — not muffle — noise produced by the exhaust of internal combustion engines, discharge of rotary blowers, vacuum pumps, hogging jets, and steam safety valves, and at the intake of reciprocating compressors and rotary blowers. Silencing of the exhaust stream is obtained by passing the flow through snubbing chambers so that it is discharged to atmosphere smoothly and quietly. Burgess-Manning Snubbers are built like pressure vessels, continuously welded throughout, without excessive weight. A wide range of both standard and special units is available for 1" through 30" and larger pipe sizes.

In our more than 50 years' research and engineering for all types of industries, we have never failed to solve a noise problem. If noise is a problem in your plant, or if you are designing a plant where turbochargers are to be installed, talk to "The Sound Engineering People." There's no obligation, and you'll find us anxious to help you in any way we can. Burgess-Manning Company, 9217 Sovereign Row, Dallas 7.

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BURGESS-MANNING COMPANY

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SHOWCASE . . .

New Literature

Tilting-disk

. . . check valves are featured in new Catalog 14-Y which gives data on applications, engineering features, operating principles, dimensions, and weight reduction. The new one-piece cast-steel valves are designed for all-welded conventional and nuclear piping systems in 900, 1,500, and 2,500-lb.-pressure classes and sizes from 6 to 20 in. The 12-page literature includes ratings, a flow index table, curves, test results, and valve-material specifications. Source: **Edward Valves, Inc., 1201 West 145th Street, East Chicago, Ind.**

New plastic-products

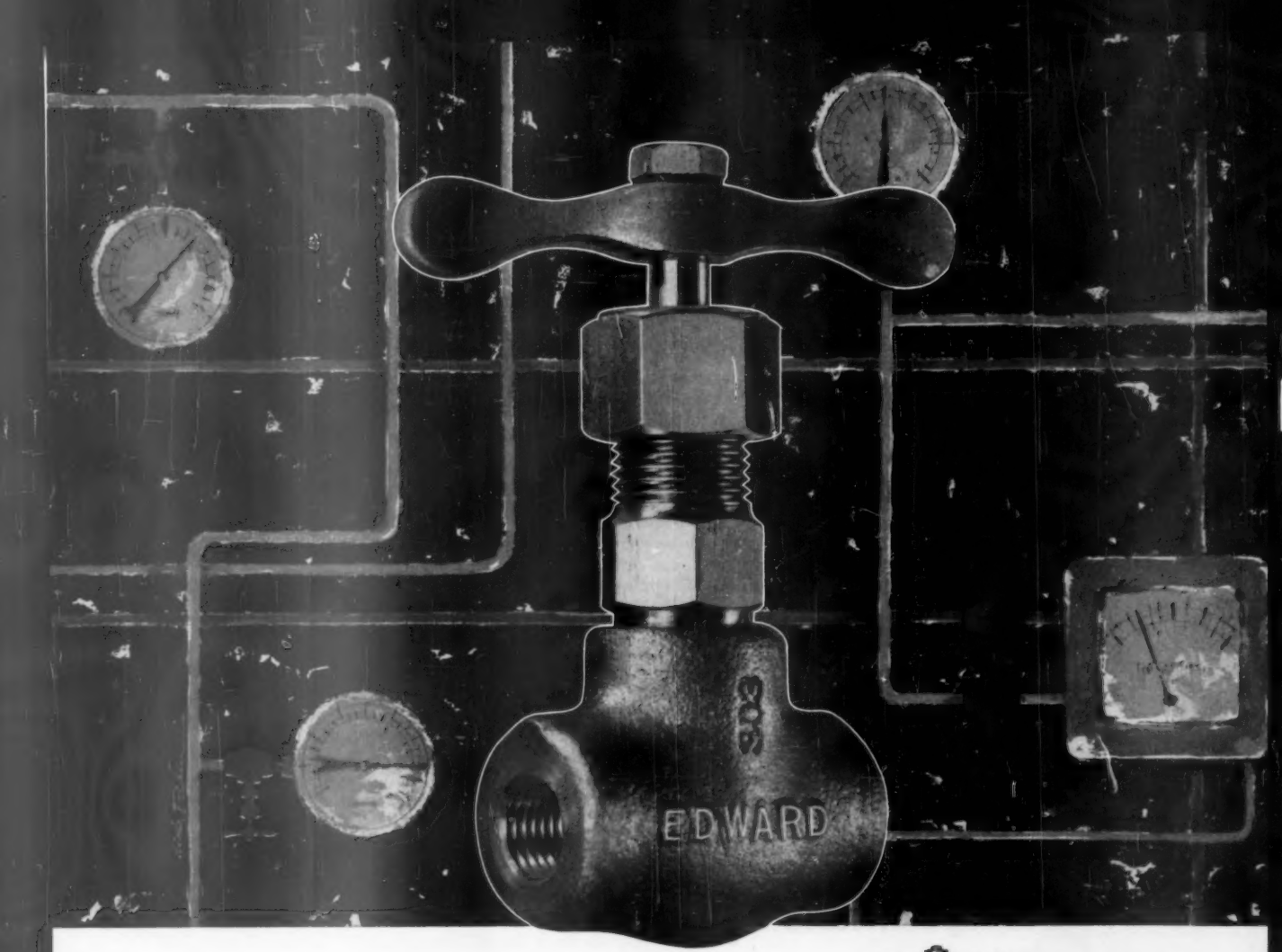
. . . catalog has just been issued which contains mechanical and electrical properties and graphs of Teflon, Raylon, and Kel-F. The 36-page publication illustrates and describes basic shapes available as well as mechanical packings and gaskets; accessories for fluid-handling equipment; custom-machined parts; thin-wall tubing; flexible wire-braided rubber-covered hose; bondable Teflon and adhesives for bonding; O and backup rings; bearings; and Teflon coatings. Source: **Plastic Products Div., Raybestos-Manhattan, Inc., Manheim, Pa.**

Strainer guide

. . . contains a compilation of reference data for the layout of fluid-flow systems and sizing of strainers, tabulated results of testings, and valve and pipe-selection information. Reference material for each strainer section is on a foldout page for easy use with any specific page in that section. The guide contains over 100 illustrations of pressure drop, temperature, and viscosity charts made from actual testings in addition to technical drawings of the strainers. Source: **Tate Engineering, Inc., 516 South Eutaw Street, Baltimore 1.**

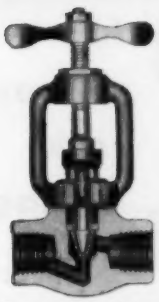
Consultant's role

. . . in business is the theme of a new 44-page booklet written for executives by a management and engineering consultants firm. The publication tells how some 85 consultants work in such fields as general management and organization planning, financing, industrial and labor relations, insurance, marketing, public relations, design,

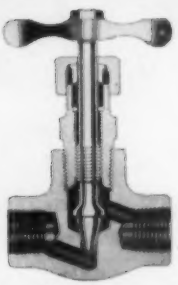


Edward Steel Gage and Instrument Valves provide dependable, finger-tip control

Edward gage and instrument valves will give you longer, more reliable service with less maintenance cost on pumps, separators, oil-field Christmas trees, and for meter, regulating, bypass, and dead-end lines. Edward gage valves are made of drop forged carbon steel or 18-8 stainless steel for sounder structure and greater strength than valve bodies machined from bar stock. Edward instrument valves have a carbon or 13% chromium stainless steel body. Carbon steel body has an integral cobalt-chromium-tungsten alloy steel seat that resists pitting and gives maximum resistance to corrosion and erosion. Choice of globe or angle body. For additional information, see your favorite distributor, or write to Edward Valves, Inc., 1212 West 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.



Instrument Valve
Fig. 952 & 2952
6000 lb WOG



Gage Valve
Fig. 152 & 4152
4000 lb WOG

Contoured T-handle on both gage and instrument valves provides easy, finger-tip control. On gage valves, the bonnet and packing nut are EValized (exclusive Edward plating process) to minimize galling and corrosion. Instrument valves have EValized gland and gland bolt nuts, stainless steel gland bolts. Taper-threaded joint between bonnet and body of gage valves prevents bonnet from backing out of valve. Instrument valves are of bonnetless design. Semi-needle, integral stem-disk is made of EValloy 13% chromium or 18-8 alloy stainless steel, hardened for wear resistance.

EDWARD STEEL VALVES
another fine product by
ROCKWELL

and consulting engineering. Source: **Commonwealth Services, Inc., 300 Park Avenue, New York 22.**

Gas-turbine-power

. . . bulletin introduces a family of 75 to 20,000-hp. lightweight turbines designed for a wide variety of applications. Eight-page Bulletin GEA-7083 describes design features, performance and operating characteristics, plus current and potential applications. Source: **General Electric Co., Schenectady 5, N. Y.**

Chromium-nickel stainless steel

. . . types are outlined in a newly revised and updated booklet now obtainable. It contains general information and technical data to help you make correct design and buying decisions. Source: **Republic Steel Corp., 1441 Republic Building, Cleveland 1.**

Oil-well tubing

. . . is described in new Bulletin 514 just published. The eight-page literature piece details Spang plastic-coated tubing for high resistance to corrosion and paraffin adhesion. Illustrations show the use of a Teflon ring in the box end of joints of this integral-joint tubing. Source: **National Supply Co., Two Gateway Center, Pittsburgh 22.**

Petroleum-waxes

. . . technical paper now available describes the structure and composition, production and refining, and analytical and functional properties of waxes with special emphasis on microcrystalline wax. A flow chart illustrates how production of wax from crude oil may be divided into a few main operations. Tables list physical and chemical properties of waxes. Source: **Sonneborn Chemical & Refining Corp., 300 Park Avenue South, New York 10.**

Cementing cost

. . . cutting is suggested in a new six-page folder describing advantages attributed to Strata-Crete 6 as an additive for oil-well cements. The literature gives technical data on the additive as well as a complete job report on results obtained with the product in a Louisiana field. Included is a comparison chart which analyzes Strata-Crete 6 and other additives. Source: **Strata-Crete Dept., Great Lakes Carbon Corp., 1404 Neils Esperson Building, 804 Travis Street, Houston.**

Sliding-gate pressure regulators

. . . now available in stainless steel are detailed in new Bulletin JNP-4. It gives features, a cutaway drawing, sizing charts, a flow curve, sample specifications, and engineering data. Included are design advantages of sliding-gate seats. Source: **OPW-Jordan Corp., 6013 Wiehe Road, Cincinnati 13.**

Specialty-tubing

. . . specifications WL-1 and WL-2 have just been published and are now being offered free to interested parties. The first booklet covers tubing manufactured from AISI 4140, 4145, 4340, and similar steels for high-strength applications. The other covers corrosion-resistant tubing. Source: **Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.**

specification for preventing rock damage:

"Coating shall be protected from damage by the application of Midwestern's KAPCO ROCK SHIELD"

The successful coating of pipelines for installation in rock areas depends to a large extent on the outer shield used . . . and Midwestern's KAPCO Rock Shield has proved to be one of the most effective on the market in living up to performance specifications and providing positive protection against costly rock damage. KAPCO is a tough, mastic composition board that provides maximum protection to pipe and coating and is available in a variety of thicknesses to meet your particular needs. Application is fast . . . simple . . . the boards are simply strapped into place with pressure sensitive filament tape or steel strapping. A complete pipe section can be covered in only a few minutes.

Stop costly rock damage that can lay your pipeline open to attacks by corrosion. Contact one of the nine conveniently located Midwestern offices for a complete explanation of the many advantages of KAPCO Rock Shield.

KAPCO

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4645 Southwest Blvd. Tulsa, Okla. HI 6-6144
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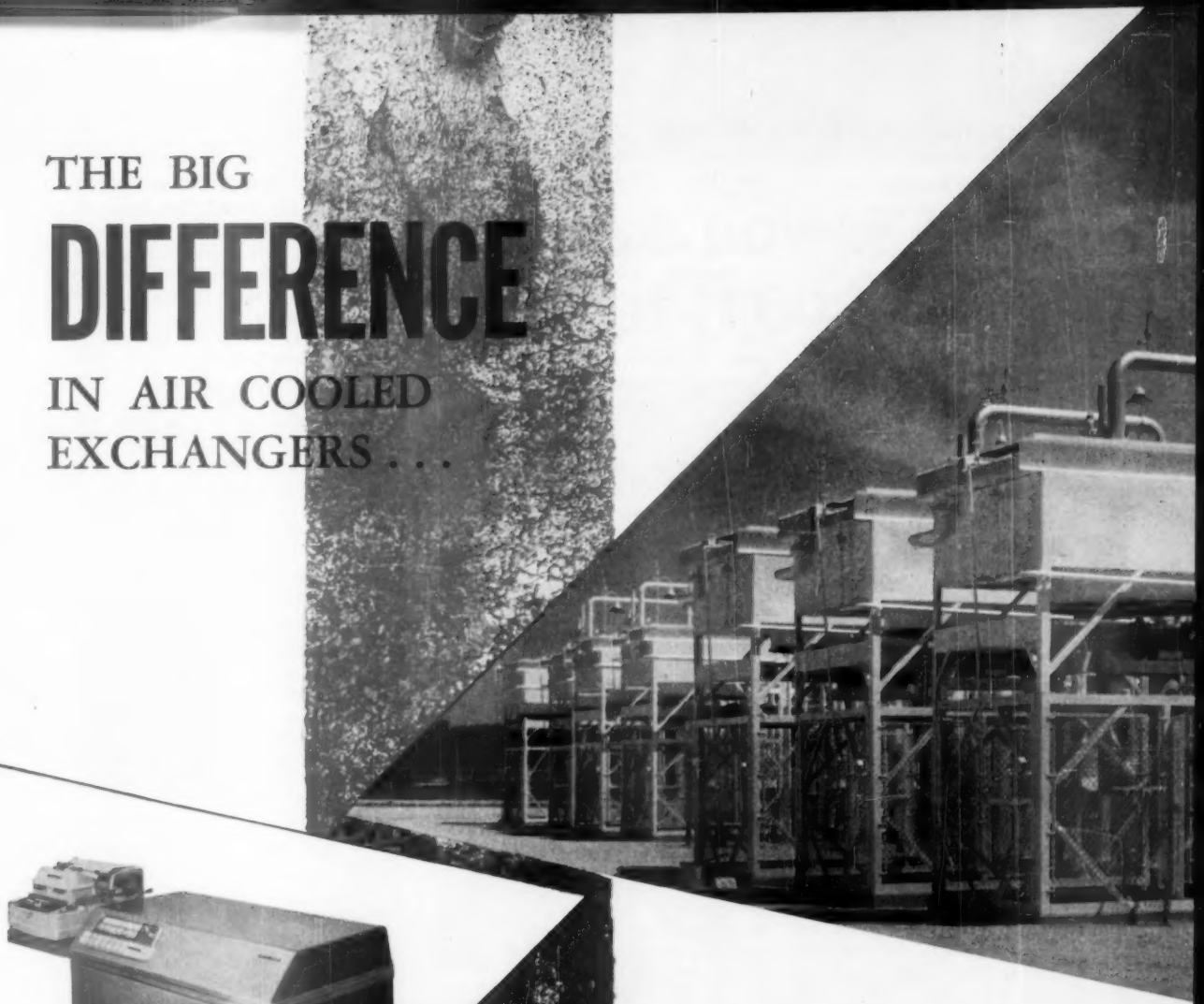
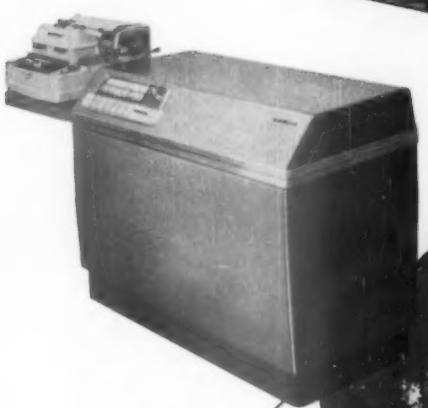
- St. Petersburg, Fla.
- Chicago, Ill.
- Pittsburgh, Pa.
- Oklahoma City, Okla.
- Des Moines, Ia.
- New York, N.Y. (export)
- Caracas, Venezuela

THE BIG DIFFERENCE IN AIR COOLED EXCHANGERS . . .





. . . uncompromising quality, through 22 years of supplying air cooled equipment to the industry. Today, as always, Happy is continually striving to improve its product through research, latest shop equipment, time, motion, method and design studies . . . all calculated to bring you the finest equipment available at the most economical level.

Now a new dimension has been added. A Royal McBee LPG-30 Electronic Computer has been installed in our Engineering Department to perform our rating calculations previously done by hand. Now, within minutes we are able to vary tube lengths, pass arrangements, number of tubes, rows of tubes, face velocities, etc.,—all of the normal variables—to find the optimum unit for your requirements.

HAPPY

THE HAPPY COMPANY—BOX 770—TULSA, OKLAHOMA

EXPERIENCE MAKES THE DIFFERENCE

▶▶▶ Equipment Men Notes

Bethlehem Supply appoints

... E. R. Phillips as manager of the Rocky Mountain region with headquarters in Denver, according to J. V. Spalding, general manager of sales. The division also announced the retirement of T. B. Simpson, a sales representative in Tulsa for 25 years.

J. V. Spalding

T. B. Simpson

Phillips joined Bethlehem at the Salem, Ill., store, and later was transferred to Grayville, Ill., as store manager. He later became division tubular manager in Dallas, manager of the Panhandle-western district with headquarters at Amarillo, and assistant to the regional manager for the southwestern region.

New sales engineers appointed

... by Garrett Oil Tools Division of U. S. Industries, Inc.

John D. Millea has been named a special sales engineer for Europe and the sterling-currency areas. He will headquarter in The Hague, The Netherlands, and will assist C. M. Peters, vice president—sales engineering.

Other appointments include: Ted W. Link, New Mexico district with headquarters in Hobbs; Jim McMichael, South Louisiana district at Marrero; Jon F. Hamlin, Southwest Louisiana district in Lafayette; Eddie Lofton, Oklahoma district in Oklahoma City; and Gary L. Fuller, office in Tioga, N. D.

Ben A. Hilliard, Jr. is named

... domestic sales manager of Baash-Ross Division of Joy Mfg. Co., reports Robert A. Forsman, director of sales and service for the Houston-based firm. Hilliard, who was Gulf Coast and export sales manager of Web Wilson Co. when it merged with Baash-Ross in February, will have his office in Houston.

B. A. Hilliard

Joining the Byron Jackson sales force in 1935, Hilliard became export manager in 1942 and general sales manager in 1950. In 1954 he moved to Web Wilson as division and export sales manager.

Delta Tank Mfg. Co., Inc. names

... Ray Noland as western region service manager for the company's Oilfield Equipment Division. Noland has been in sales and service of petroleum equipment for 15 years in the Texas - Louisiana area. Other Delta appointments include: E. A. Beyer and Dick L. Herrick, sales representatives for the Lafayette, La., oil-field-equipment office; Clint B. Warren, regional sales engineer in Houston; and Arnold A. (Wheat) Nowlin, sales representative in Houston.

Ray Noland

NEW OKLAHOMA DISTRIBUTOR is Harley Sales Co., Tulsa, for Worthington Corp.'s horizontal reciprocating plunger pumps. Shown, from left, are: R. N. Franz, Worthington regional sales manager; W. J. Taggart, Worthington distribution representative; Bob R. Neal, Harley Sales Co.; R. W. Johnson, Harley sales manager; R. K. Grobbloz, Worthington power-pump sales manager; and L. J. MacKenna, Tulsa, Worthington district sales manager. Harley maintains a warehouse and service organization in Tulsa, Wichita, and Houston.

J. B. Knauth appointed salesman

... at Liberal, Kans., for Jones & Laughlin Supply Division, announces W. L. Wolfe, vice president in charge of sales. Knauth had been assigned at Liberal as a sales trainee prior to this advancement.

Meanwhile, Wolfe announced that J. K. Robinson had been assigned as resident salesman at Okmulgee, Okla. Robinson began with J&L as a storeman at Hobbs, N. M., in 1936. He was transferred later that year to the Okmulgee store. Robinson was promoted to store manager at Okmulgee in 1943 and served in that capacity until his current assignment.

Allison Peters joins the staff

... of Joe Stine, Inc., of Houston, where he will do sales work in the drilling - specialty field. For the past 13 years Peters has been connected with Hunt Tool Co. in sales and executive capacities. Prior to that, he served 11 years with Texas Iron Works.

Raymond Cappel is transferred

... to the New York regional office of Jefferson Chemical Co., according to R. E. Werley, Jr., sales manager. Formerly resident salesman in Tulsa, Cappel will now handle accounts in the Pennsylvania and New Jersey area. He became a salesman for Jefferson's Houston regional office in 1957.

It was also announced that Earl Gilbert has been appointed office manager for the Chicago sales office, where he will supervise order processing and clerical activities for the Chicago region. He joined Jefferson's Chicago office staff in 1956.

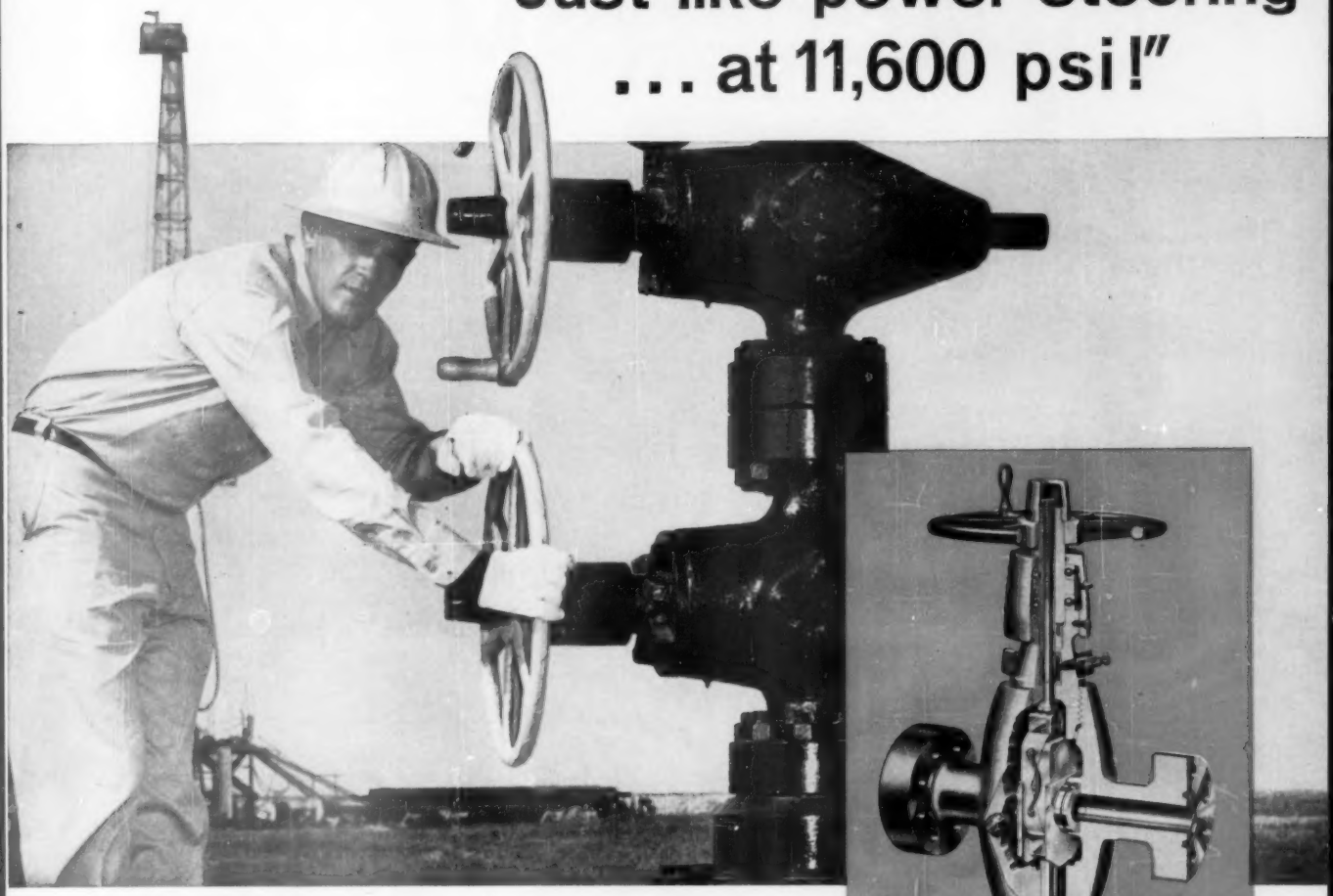
Macwhyte Wire Rope appoints

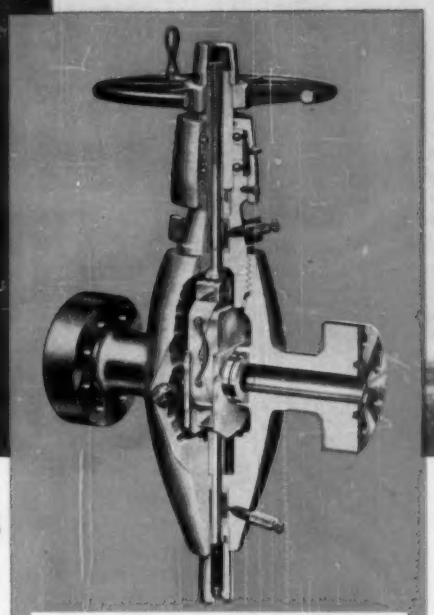
... Russell F. Hendrick as assistant Pacific Coast manager. Hendrick has been associated with the wire-rope industry both with a manufacturer and, more recently, conducting his own distributorship of wire rope and allied products. He will headquarter at the company's offices in San Francisco, and will assist Fred M. Sime, Pacific Coast manager, in the 13 western and Pacific Coast states.

Hill, Hubbell & Co. is acquired

... by National Malleable & Steel Castings Co., of Cleveland. Hill, Hubbell, a division of General Pacific

"Just like power steering ... at 11,600 psi!"





W-K-M® Balanced Stem Valves

These valves are the easiest operating high pressure valves ever made.

Only W-K-M Balanced Stem Valves are designed to overcome the heavy thrust loads carried by bearings and threads in single stem valves. A second stem is attached to the bottom of the gate to balance out body pressure that acts against the operating stem. The only loads to be overcome in opening or closing this valve are packing friction and normal operating loads.

Next time — and every time — specify W-K-M! *Available at leading supply stores everywhere.*

PRODUCT OF W-K-M's *Creative Engineering*

WRITE FOR CATALOG 200

W-K-M

DIVISION OF ACF INDUSTRIES INCORPORATED

P. O. BOX 2117, HOUSTON, TEXAS

W-K-M Balanced Stem Valves feature through-conduit gate construction, parallel expanding gates, controlled force seating, pressure seal bonnets, super-finished stems supported on roller bearings, seating surfaces sealed away from the lading flow.

Sizes: 1-11/16" through 2-9/16".

Working Pressures: 10,000 and 15,000 pounds.

Write for Test Bulletin WP-1058. It describes how this superlative valve successfully passed the oil industry's most punishing tests.

5912-R

Developed in the field...by a major oil company production superintendent
... who wanted a plunger that he could redress easily, quickly, and economically. His answer was this new plunger with its easy-to-make-up split rings and sectional-type ring spools that can be quickly interchanged as necessary, without having to discard the entire assembly. Other producers men throughout the oil patch have since run hundreds of these plungers ... in rod and tubing pumps ... in sandy and corrosive fluids ... and in average wells. Every plunger has given the desired service — and repair bills have been negligible. The reason is in the design of the plunger, and the way the component parts make up.
The rings spools are made in short (10") sections — instead of a long, single piece, or individual ring spacers. They're also made of bronze, and won't corrode to the mandrel or to each other, nor will the rings bond to the spools. The rings are extra long-wearing, and because they're made of a special material developed specifically for oil well pumping, they seal perfectly, with a minimum of presoaking before running.
You, too, will find that these plungers have everything you want for efficiency, utility, long service, and economical maintenance. Ask your supply store. They'll recommend them also — and you'll be glad they did!
Harbison-Fischer Spool-Type Plunger
PATENTED
HARBISON-FISCHER MFG. CO.
FORT WORTH
"BEST PUMPS IN THE OIL PATCH"

Corp., has plants in Lorain and Youngstown, Ohio; Denver; Hammond, Ind.; and Napa, Calif. About 400 persons are employed. The company, which applies protective coatings to pipe, will be operated as a wholly owned subsidiary.

Baird Mfg. names Jim Thomas

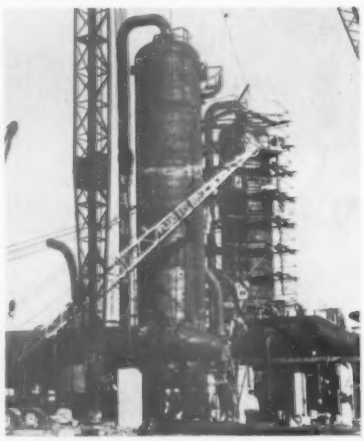
... to the post of sales manager of the firm's northern division. The area comprises territory from Tulsa west to the Four Corners, north to Canada, and east to Pennsylvania. Thomas has been active in oil-field sales work for 17 years.

Jay M. Sharp is board chairman

... of the Association of Industrial Advertisers. He had been serving as vice chairman of the association, and is manager of general advertising, Aluminum Co. of America. Sharp succeeds H. A. (Hi) Harty, manager of advertising and sales promotion of Wolverine Tube Division of Calumet & Hecla, Inc.

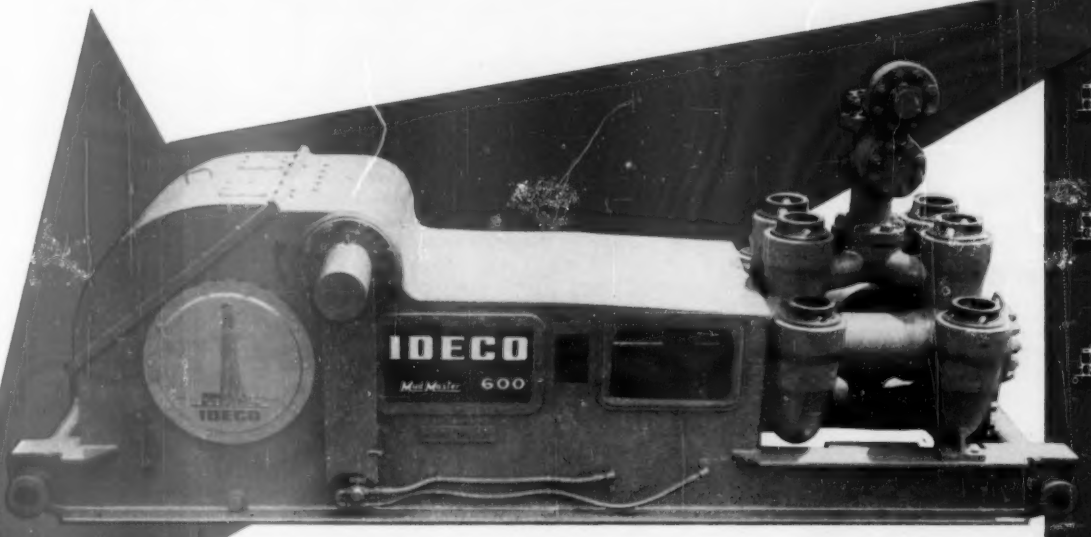
Clark Bros. Co. announces

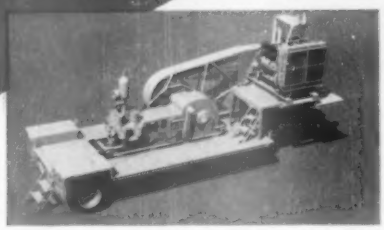
... the sale by Clark Compressor Co., Ltd., Calgary, Alta., a Dresser subsid-



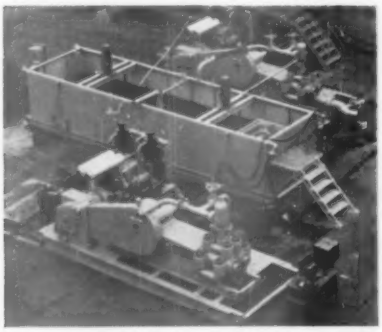
GIANT ABSORBING TOWERS, representing some of the heaviest steel-fabricating work ever to come out of Southeast Texas, are shown being installed at the Rayne, La., process plant of Union Texas Natural Gas Corp. The vessels, produced by the recently modernized steel-plate-fabricating facilities of U. S. Steel's American Bridge Division plant at Orange, Tex., are 60 ft. high and 11½ ft. in diameter. Built of 4-in.-thick, extra-high-grade steel, they weigh 450,000 lb. each. Fluor Corp., Ltd., Inc., designed and installed the units for the Houston-based processing company.

CHECK THESE *12 All-steel* IDECO MUD PUMPS





One of 12 trailer-mounted MM-200 pumps for one customer.



Two MM-300 pumps being assembled for testing.

Power pumps that deliver a high pressure punch — Ideco builds them in twelve sizes, duplex and triplex, from 200 to 1250 H.P.

These all-steel pumps feature precision-built power ends and streamlined one-piece fluid ends which work together as a tough team to help you show more profit in today's competitive market.

Ideco pumps are a product of the application of years of engineering experience by men who really know pumps. Fabricated all-steel design assures minimum vibration . . . heat treated pinion shaft and Falk herringbone main gear can be reversed for double life . . . double-row Timken tapered roller bearings assure durability. Threaded valve pot covers speed valve servicing and reduce crew work. Gamma ray and strain gauge tests prove the strength of every part.

So remember, when you think of mud pumps . . . think of Ideco — you'll get the best. Just ask the men who have been using them.

There is no Substitute for Quality

IDECO P. O. BOX 1321 DALLAS, TEXAS DRESSER INDUSTRIES

iary in Canada, of three gas-turbine centrifugal-compressor sets to Trans-Canada Pipe Lines, Ltd., as part of the latter's multimillion-dollar expansion program to export natural gas to the United States.

The turbines are Clark Model 305 regenerative-cycle dual-shaft machines rated at 8,370 hp. each (at NEMA conditions). They will drive Clark 30 by 30-in. single-stage centrifugal pipeline compressors, which will pump about 700 million cubic feet of gas per day through one of the world's largest and longest pipelines.

Continental-Emsco Co. completes

. . . a new shop building at Odessa, Tex., for the reconditioning and assembling of used equipment. The 46 by 100-ft. building is equipped with a 7½-ton electric hoist which travels the length of the building, a heated Oakite vat, stationary steam cleaner, hydraulic press, and electric grinder.

Drilling & Service to expand

. . . its sales and service facilities in the Southwest. The company, headquartered in Dallas, also announced the promotion of two executives who will head up new offices in New Orleans and Oklahoma City.

R. D. Oliver has been named division manager in charge of the New Orleans office. James Cowan, a member of the firm for the past 10 years, has become Oklahoma division manager. The new D & S building in Oklahoma City will be operations base for the Oklahoma-Kansas area.

Udell Sales & Service acquired

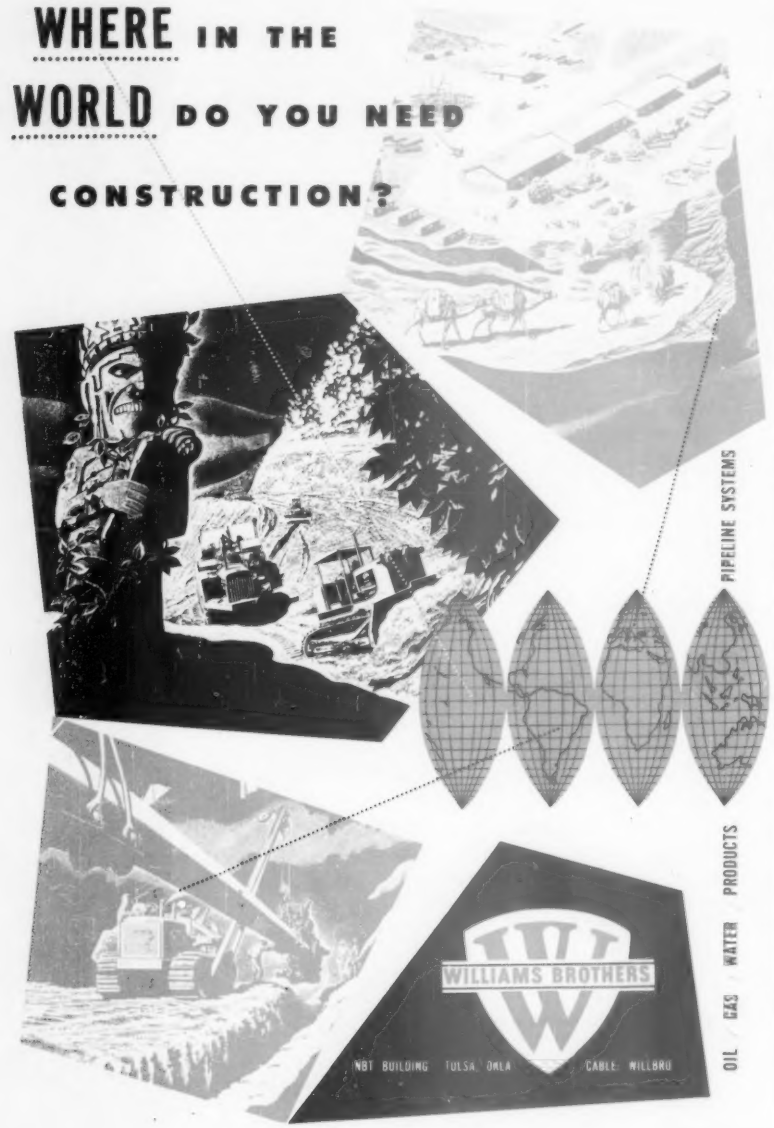
. . . by J. C. (Red) Wright, and is now operating as Udell Sales & Service, Inc., with Wright as president. The Odessa, Tex., firm was formerly a subsidiary of Udell, Inc.

The new company has been franchised to operate the Udell subsurface flow-meter, well calipers, and electrical collar locator, and has been appointed executive sales representative in West Texas and New Mexico for Udell packers, packer hold-down retrievable chokes, gas valves, free pistons, and blank sleeves.

Wright, who is also president of Wright Rental Tools, Odessa, has named Conway Young as vice president and general manager of Udell Sales & Service, Inc. Young previously was manager of Lane-Wells Co's Rocky Mountain division.

Walter L. Ficklin is appointed

. . . city representative in charge of the new Denver sales office of Bovaird Supply Co., according to W. J. Bovaird, sales manager. Ficklin went to work for National Supply Co. in 1953. For the past 2½ years, he has been at the Denver office as rotary-equipment man. At the time he joined Bovaird, he was Denver city salesman.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NEWLY ELECTED OFFICERS of the Petroleum Electric Power Association are shown conferring on the 1961 convention site at Tulsa. Election was held at the group's annual meeting at Jackson, Miss. From left are: Kirby Dawkins, West Texas Utilities Co., secretary-treasurer; W. M. Larkin, Gulf States Utilities Co., president; and B. F. Thompson, Public Service Co. of Oklahoma, vice president.

Keeping oil and gas *on the move*

Your Profit-Pipe is LIGHTWALL by SOUTHWESTERN

It gives you heavyweight performance for less money: lower initial cost, ease of installation, flexibility, greater flow-through and long trouble-free service.

SOUTHWESTERN gets your order on the way without delay . . .

keeping oil and gas on the move. We take pride in our fast, dependable delivery from large warehouse stocks. Southwestern makes a full range of sizes up to 4.500" O.D. in wall thicknesses up to .188 wall to meet almost every need and every joint is top performance quality.

Take a look at LIGHTWALL by SOUTHWESTERN...your Profit-Pipe

SP PIPE

LICENSED BY THE AMERICAN PETROLEUM INSTITUTE

SOUTHWESTERN PIPE, INC.

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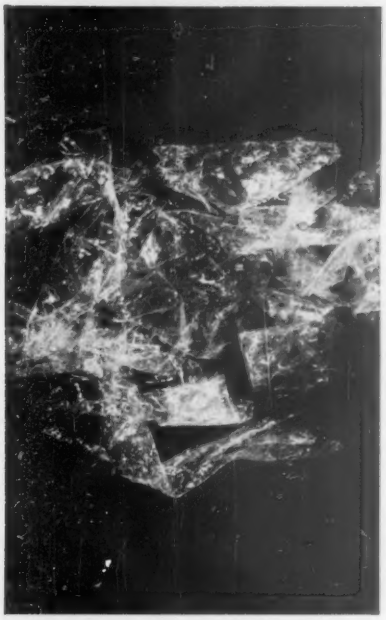
THIEF ZONE?



JELFLAKE

Thief zones cost money and time. One of the surest ways to avoid drilling mud and slurry loss to thief zones is to have a supply of Jelflake® on hand. When added to the mud, Jelflake goes to work to plug and plaster — to seal off the thief zones. Jelflake is economical. One 25-pound bag of this plastic foil can cover approximately 500,000 square inches. Get Jelflake before you get in trouble. Available at major mud distributors and all Dowell stations.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

Contractors take practical view of "turnkey" job

THE TERM "turnkey," when applied to oil and gas-well drilling contracts, means many things to many people.

In its purest form it would probably mean, in the case of a dry hole, in exchange for a given lump sum of money, the delivery by the contractor to the operator of a complete file on the abandoned well.

This file would include: surveyor's plat of location, Railroad Commission Form 1, permit to drill, board of water engineers surface casing requirements, complete driller's log, complete daily drilling reports, copies of electric logs run, copies of core analyses, copies of drill-stem tests completed, Railroad Commission Forms 2-A and 4, plugging record, affidavit establishing position of bottom of hole, and a signed release from the landowner for all damages.

In the case of a producer, it would be assumed that the operator would take over at the point of running production string and would handle the well from there forward. For these "pure" turkey services the contractor would have charged a fee commensurate with the risks involved and the cost to the operator would have been considerable. In fact, with prudent South Texas drilling contractors, it is believed the operator could not afford the price charged. In view of this there have been relatively few pure turnkey drilling contracts in South Texas as described.

Three Reasons

It is believed there are three basic reasons for operators to seek some type of turnkey drilling contract. These are: to avoid the necessity for a large staff, to transfer supervision, and to transfer responsibility.

The idea of a turnkey contract in South Texas possibly grew from the situation in which an independent geologist or lease broker secured a lease or a farmout and wanted a well drilled on his prospect. This person secured whatever dry-hole and bottom-hole money he could, loaded the deal with an override and sold portions of his deal to investors to raise his drilling costs. Since his primary function was the putting together and selling of the deal, and since he had no staff to handle the details of the drilling, he took it to a drilling contractor. An arrangement was made whereby the contractor, in return for a run of money sufficient to cover his costs plus a one-quarter working interest in the deal, agreed to handle the drilling of the well and the evaluating of the prospect.

Contractor's Profit

The one-quarter interest in this case represented the contractor's profit for operating his rig and the premium, or cushion, for assuming the risks involved in the well. This has been and continues to be a normal arrangement in South Texas, with most contractors willing to enter into a turnkey deal involving an interest.

The use of a type of turnkey contract to transfer supervision and reduce operator costs has also been widely used in South Texas. Since the contractor will have supervision on the job, he can handle many of the normal operator functions along with his own. If there are no particular hazards in the area, the contractor may, for a price, agree to assume the cost of roads and location, the cost of purchasing, running and cementing surface casing, and the cost of plugging and abandoning the well. The assumption of these operations and the supervision of the remainder of the well effects a savings for the operator in supervisory costs. The contractor, unlike other suppliers for the oil industry, will normally furnish third-party services at his cost, i.e., with no markup for handling.

The type of turnkey drilling contract in which the operator transfers certain of his responsibilities to the contractor is the one which is meeting resistance by South Texas drilling contractors. Many contractors in this area are not interested in this type of contract at any price. Reasons given for this attitude are that, in order for the contractor to protect himself against hazards normally borne by the operator, he must charge such a huge sum that the operator feels preyed upon if trouble does not develop and the costs are not incurred by the contractor.

Other contractors are willing to ac-

Adapted from paper presented by Walter Kalteyer, Hunt Drilling Co., Corpus Christi, at 1960 spring meeting of the Southern District, Division of Production, API, San Antonio.

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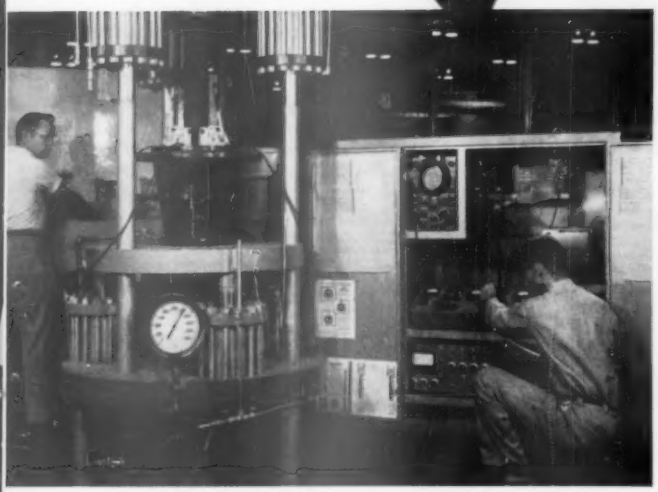

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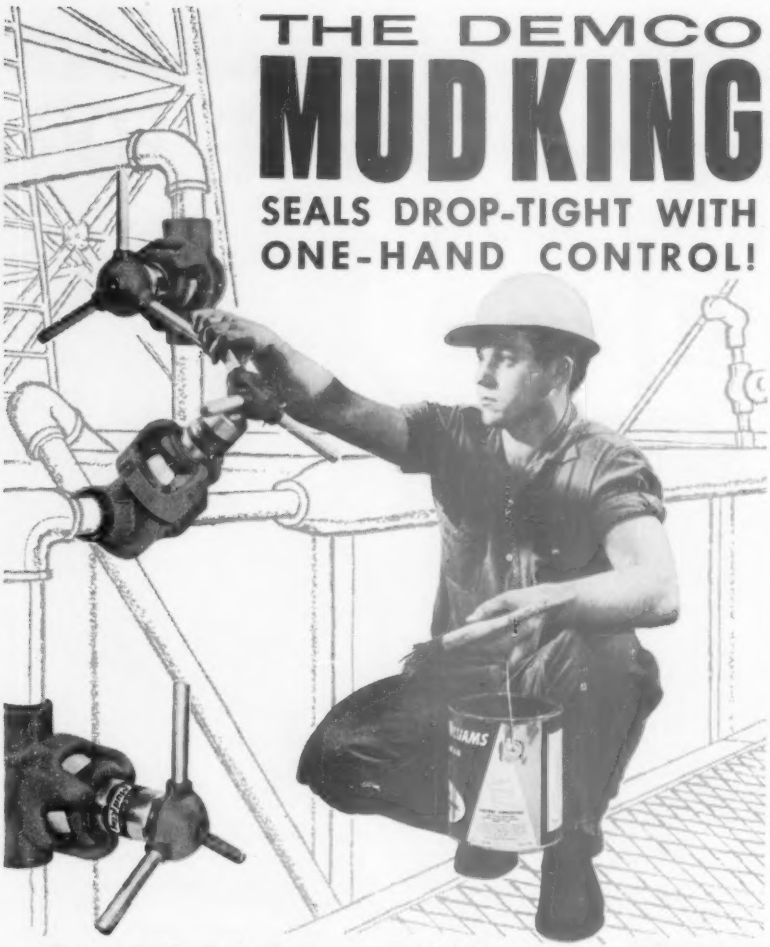

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cept certain of these operator responsibilities if sufficient cushion can be allowed or if stops or maximum costs on certain items can be established. No insurance company will insure without charging a premium, and contractors cannot be expected to insure the operator against hazards without adequate compensation.

The fact that major companies have drastically reduced the number of their own rigs, is evidence they feel the drilling contractor can drill their wells more economically. In the last 20 years the contractor's share of wells drilled in the United States has increased from 72 to 96%. During this same period, while the total average cost to the operators for the drilling and equipping of wells rose steadily from $7.50 to $13.25 per foot, the average amount paid the drilling contractor remained virtually constant, rising from $4.25 to $4.50 per foot. Concurrently with the foregoing, the contractor's costs have increased 108% while his footage drilling prices have decreased 12%.

Contractors were able to stay in business during this time only by increasing their efficiency and increasing penetration rate by a figure of 42%. This all speaks well for the contractor driller except that because of this squeeze he has been unable to properly maintain and to replace his outmoded equipment. An indication of the seriousness of this situation reveals that, with the exception of a flurry or buying in 1954, the total number of draw works of 160-hp. rating and above sold annually by United States manufacturers for use in both foreign and domestic fields has fallen from 460 in 1951 and 1952, to 124 in 1958. Though these are the latest figures currently available, it is estimated even fewer draw works were sold in 1959.

It is believed that the major producers are vitally interested in a strong contract-drilling industry; and if this interest is not manifested, these producers may find it necessary to again operate drilling rigs of their own with a resultant higher cost per foot for wells drilled. This, then, is the reason contractors cannot accept additional cost items without a commensurate increase in income.

Options open to operators using South Texas contractors are: continue to have interest wells drilled on a pure turnkey basis, continue to have wells drilled on a turnkey basis involving a transfer of supervision on certain items, and have wells drilled on a turnkey basis involving a transfer of responsibility with certain cost stops inserted and by paying a premium for being insured.

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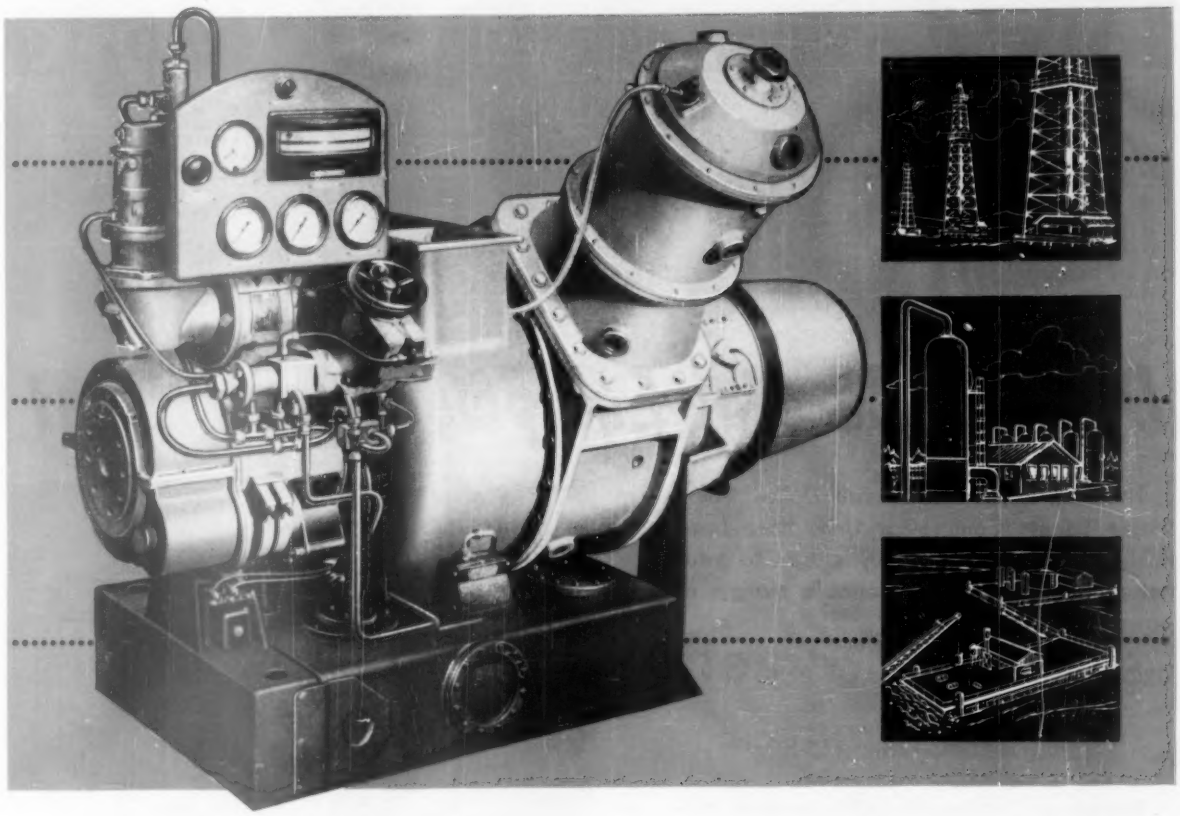

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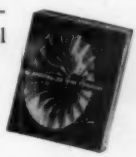

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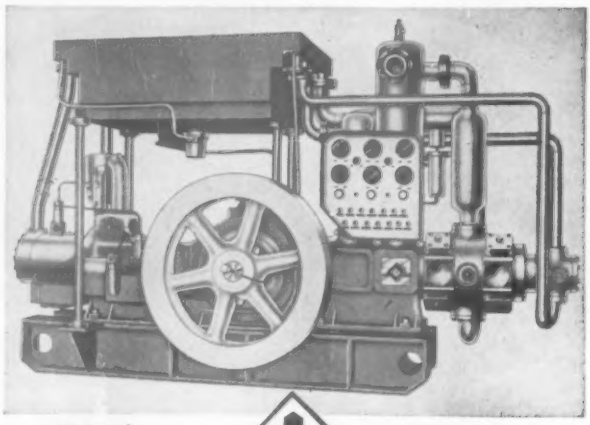

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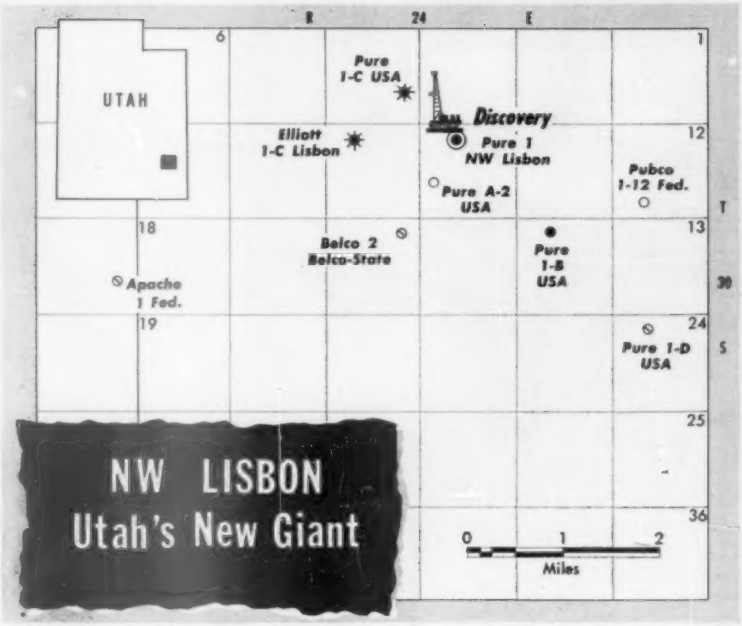

CURRENT STATUS of exploration at Northwest Lisbon, Utah's newest major field. Located in northern San Juan County, the field has just seen the completion of the fourth successful well; of the four, three have found both Mississippian and Devonian production. Elliott Production Co. 1-C Lisbon Valley, the newest producer, failed in Devonian.

Northwest Lisbon justifies early predictions

BY FRANK J. GARDNER

AS Elliott Production Co. racked up the fourth good producer last week, Northwest Lisbon field took on the look of a giant. It's still too early to be sure, but as six new stepouts chew their way down, the character and size of the field will emerge, and the Paradox basin will probably have its third giant field.

The Elliott well, 1-C Lisbon Valley, Section 9-30s-24e, San Juan County, Utah, flowed 272 bbl. of oil per day on 16/64-in. choke. Production is from Mississippian at 8,767-8,830 ft. It was drilled to total depth 9,533 ft. in Devonian; fair showings of oil were found in McCracken-Devonian at the 9,400-ft. level, but it failed to produce commercially.

Two commercial pays . . . Actually, this was only the second official completion in the field. But two Pure Oil Co. extensions are assured producers. Pure 1-B USA was spudded at the turn of the year in Section 14-30s-24e, and for a time was a tight operation. Tests of Mississippian between 8,192 and 8,548 ft. resulted in a flow of 413 bbl. per day of condensate and 6,200 M.c.f. of gas through 35/64-in. choke. Pure shut in this zone while testing McCracken between 8,905-98 ft.; here, flows of 216 bbl. of oil per day on ½-in. choke were recorded. An earlier test of this interval had yielded as much as 841 bbl. daily on ½-in. choke. Total depth of the 1-B USA is 9,022 ft.

Simultaneous testing of the Pure 1-C USA in Section 4-30s-24e has yielded gas flow at rate of 8,750 M.c.f. per day through 40/64-in. choke; the 1-hour test also recorded 30½ bbl. of 72.6° condensate. Production is from Mississippian zone at about 8,100 ft. At 9,126 ft. total depth, the well is bottomed in Devonian, and operator continues testing of the two formations.

Plus seven new tests . . . Meanwhile, three long stepout wells are on the way down, and four new locations have been staked. The drillers include Pure's 1-D USA (Section 24-30s-24e), now nearing 6,000 ft.; Belco Petroleum Corp. 2 Belco-State (Section 16-30s-24e), near 4,500 ft.; and Apache Drilling Co. 1 Federal, 2½ miles west of the producers in Section 13-30s-24e, just getting under way.

New wells not yet spudded are Pure A-2 USA,* lying between the discovery well and 1-B USA in Section 10; Pure 2-C USA, a northward stepout in Section 3; Pure 2-D USA,* a mile east of 1-B in Section 13; and Pubco Petroleum Corp. 1-12 Federal, east of the producers in Section 12 (see map). Pubco has a second new location 2 miles east of the field in Section 20-30s-25e; this is the 2-20 Lisbon-Federal, not shown on map.

Of the seven new operations, perhaps the most crucial for the future of Northwest Lisbon is Pure 1-D USA. If it should successfully extend production 1½ miles farther southeast, a large amount of prospective area will accrue to the field. Similar expansion could come from success at Pubco's 1-12 Federal and Pure 2-D USA.

As exploration of the anticlinal structure moves gradually eastward and southward (and this appears to be the trend), speculation arises as to the relationship of Northwest Lisbon to a companion discovery of 1959 at Southeast Lisbon, 15 miles away in northwestern San Miguel County, Colorado. There, Pure has two indicated producers and a third well going down. It isn't likely the two fields will ever merge, but Rocky Mountain observers are beginning to wonder.

Justify a label . . . Thus it seems that the Journal's designation of Northwest Lisbon as "discovery of the year" for 1959 is being fully justified. The discovery, completed at the end of the year, was Pure's 1 Northwest Lisbon, first Devonian producer in the Paradox basin. It made 587 bbl. per day of 44°-gravity oil from McCracken at 8,251-8,348 ft. Commercial gas flows were found in Mississippian rocks, but no completion was made in that formation.

*At press time, a change in location of Pure A-2 USA was announced (from NW SW Section 10 to NE SE Section 10); therefore the location shown on the map is in error. Announcement of Pure 2-D USA was too late for the map.

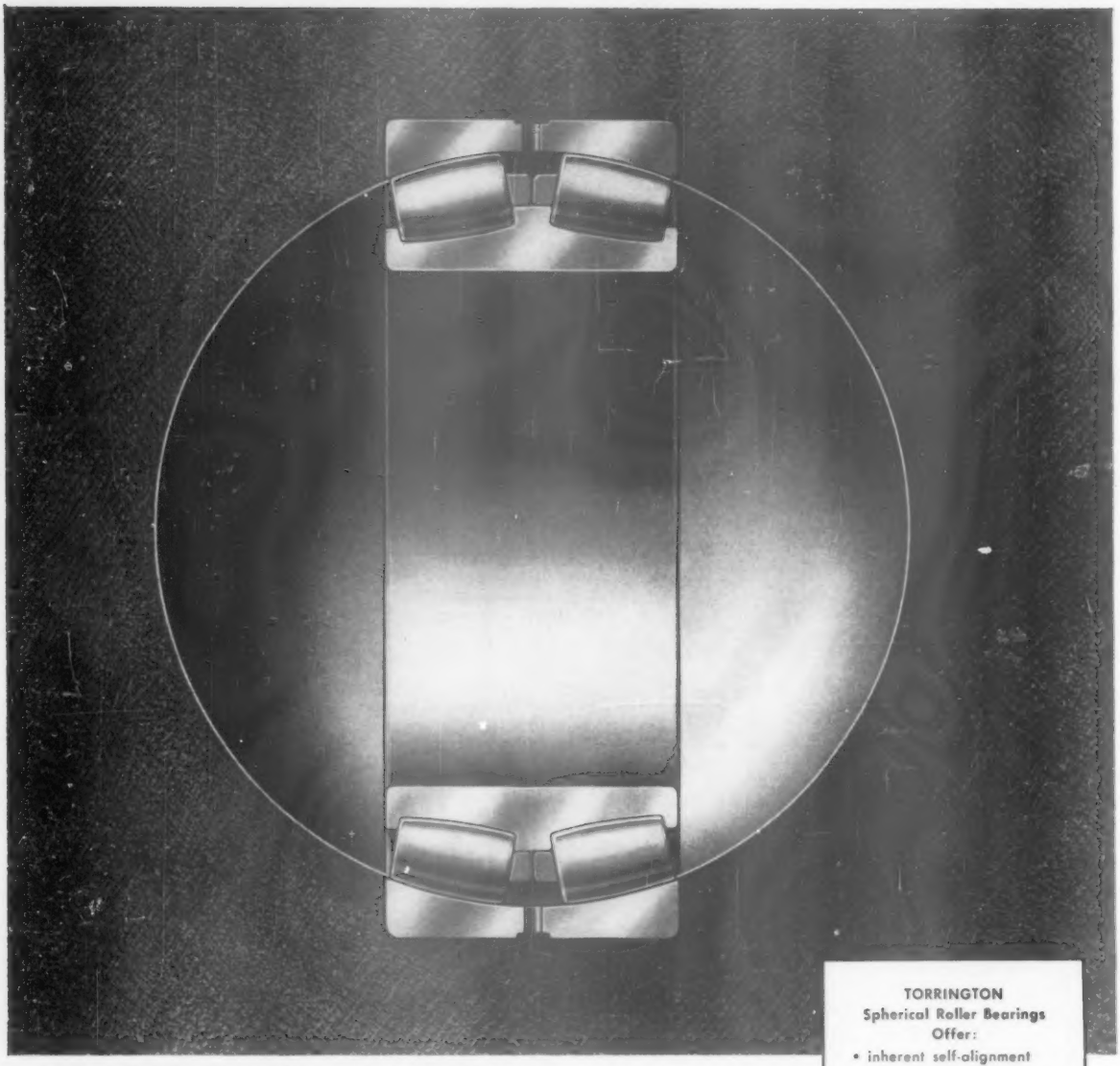

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TABLE 1

DEVICES \ USES	Correlation	Lithology	Bed Thickness	Depth Control	Flushed Zone Resistivity-Rxo	Invaded Zone Resistivity-Ri	Uncontaminated Zone-Rt	Downhole Mud Resistivity-Rm	Water Salinity & Rw	Percent Porosity	Oil & Water Saturations	Detection of Gas	Permeability Studies	Invasion Studies	Hole Diameter & Volume	Mud Cake Thickness	Caves & Fractures	Hole Inclination & Deviation	Dip & Strike of Beds	Locating Cement	Locating Casing Collars	Locating Water Source	Detecting Chlorine Content	Detecting Oxygen Content	Detection of Hydrocarbons	Salinity of Mud	Drilling Time	Formation Pressure	Nature of Formation Fluid	Sample of Formation	Picture of Rocks and Fractures
S. P. Log	*	*	*	*					*				*	*					*			*				*					
Static S. P.									*				*																		
Short Normals	*	*	*	*		*				*			*	*											*						
Long Normals	*	*				*	*				*		*	*											*						
Short Laterals		*				*	*				*		*	*											*						
Long Laterals		*					*				*		*	*											*						
Limestone						*	*			*				*											*	*					
Point Resistance	*	*	*	*		*																			*						
Induction 5,6	*	*	*	*			*				*		*	*											*						
Laterolog 3,7	*	*	*	*		*	*				*		*	*											*						
Guard	*	*	*	*		*	*				*		*	*											*						
Laterolog 8	*	*	*	*	*	*					*	*	*	*											*						
MicroLog		*	*	*	*			*	*				*	*			*								*	*					
Microlaterolog		*	*	*	*			*	*				*	*			*								*	*					
Proximity	*	*	*	*	*				*				*	*			*								*						
Acoustic	*	*							*			*		*			*								*						
Gamma Ray	*	*	*	*									*																		
Neutron	*	*	*	*					*			*	*	*											*						
Chlorine														*									*		*						
Oxygen																								*	*						
Density	*	*		*					*								*			*											
Tracer													*									*									
Spaced Neutron													*	*								*			*						
Nuclear Magnetism													*																		
Drilling Time	*	*																									*				
Directional																		*													
Dipmeter																			*												
Caliper	*	*												*	*	*	*														
Sonar Caliper														*			*														
Mud												*													*	*					
Sidewall Cores		*								*	*		*												*				*	*	*
Fluid Tester											*	*	*									*			*	*			*	*		
Casing Collar				*																	*										
Magnetic Susceptibility													*	*			*														
Temperature	*	*										*		*						*		*									
Downwell Camera																															*
Photoelectric																						*						*			

THIS CHART shows what modern well logs can do. Recent rapid advancements emphasize . . .

BY R. G. HAMILTON

. . . who, since 1949, has headed Hamilton Well Log Consultants, Tulsa. He was formerly area manager for an electric-logging firm in the Mid-Continent area. He has conducted logging schools in many areas of the U. S., Canada, Mexico, and South America. Dr. Hamilton graduated from Depauw University (A.B.) and was awarded M.S. and Ph.D. degrees from the University of Iowa. In 1958 he organized the Society of Professional Well Log Analysts and is an officer of that group.

The revolution in well logging

TODAY it can be said that the fantastically rapid introduction of new logging tools and improved methods for interpretation has created a revolution in well logging.

In 1927 the Schlumberger brothers recorded the first electric log in Pechelbronn, France. An engineer stood over a simple instrument, out of doors, and recorded resistivity data foot by foot. A helper was nearby with an umbrella in case of rain.

In 1929, the first electric log was recorded in the United States, and in 1931 a pioneering self-potential log, a new curve, was recorded in eastern Venezuela.

In each successive year, with the exception of the war years, new curves and new types of well logs were introduced. Fifteen basically new logs were introduced from 1927 to 1948, in 21 years, but in only the past 9 years, 18 new logging methods and basically new inventions have been introduced.

In 1927 Schlumberger Well Surveying Corp. recorded a single resistivity curve with primitive equipment costing only a few hundred dollars. Today an oil company can record at least 40 different curves and logs in a well with downhole instruments and surface equipment that are electronic marvels costing upwards of $100,000 per field unit. Today there are 10 broad logging groups (see chart above).

In the early years, logs were used principally for correlation and depth control. Today, with advanced interpretation techniques numbering about 20, logs provide valuable information about the quantity of oil or gas in place in the formations, magnitude of the rock porosities, information about the salinity of the formation waters, and detailed lithologic information. Some nuclear methods even give an appraisal of the kinds of ions in the fluids and formations, such as hydrogen, chlorine, oxygen, and calcium. It is probable that in the near future certain combined logs will provide a bulk chemical analysis of the formations. Methods for qualitatively evaluating the formation permeability have also been developed.

In 1927 only the Schlumberger brothers and a few associates knew anything about electric logs or were even thinking of the possibilities of obtaining information about rocks and formations in a borehole by electrical methods. Today, logging companies employ thousands of special-

TABLE 2
CHRONOLOGICAL INTRODUCTION OF PRINCIPAL WELL LOGS, METHODS & DEVICES

1927—First electric log, Pechelbronn, France—Schlumberger.
1929—First U. S. A. log—Schlumberger.
1931—Self-potential log, Venezuela—Schlumberger.
1935—Temperature log—Schlumberger.
1936—Photographic recording—Schlumberger & Halliburton.
1936—Sidewall coring—Schlumberger.
1937—Automatic drilling time log—Geograph.
1938—Caliper log—Halliburton.
1939—Gamma ray log—Well Surveys.
1939—Mud log—Baroid.
1940—Photoclinometer for continuous hole deviation—Schlumberger.
1941—SP dipmeter—Schlumberger.
1941—Neutron log—Well Surveys.
1946—Induction log—Schlumberger.
1948—MicroLog—Schlumberger.
1949—Radioactive tracer log—Birdwell.
1950—Laterolog—Schlumberger.
1950—Guard log—Halliburton.
1950—Densilog—Lane-Wells.
1951—Microlaterolog — Schlumberger.
1952—Continuous dipmeter—Carter Research Laboratory.
1954—Acoustic log—Seismograph Service Corp.
1955—Side-wall formation-fluid tester—Schlumberger.
1955—Downwell camera—Birdwell.
1956—Induction-electric log—Schlumberger.
1956—Sonar caliper log—Dowell.
1957—Laterolog 8 log — Schlumberger.
1958—Salinity log—McCullough Tool Co.
1958—Cemoton log—Lane-Wells.
1958—Proximity log—Schlumberger.
1958—Induction 6FF40" log—Schlumberger.
1958—Activation, accelerator, or oxygen log—Well Surveys.
1958 and 1959—Nuclear magnetism log—Standard of California Research Lab.

TABLE 3—CLASSIFICATION OF WELL LOGS AND EXPLORATION DEVICES FREQUENTLY EMPLOYED IN FORMATION EVALUATION

A. **Potential logging:**
- Self-Potential or S.P. log
- Static SP log
- S.P. dipmeter log

B. **Resistivity logging:**
- Point resistance log
- Normal & lateral resistivity curve
- Laterolog 3 & 7 logs
- Guard log
- Laterlog 8
- Proximity log
- MicroLog
- Microlaterolog
- Resistivity dipmeter log

C. **Electromagnetic & Magnetic logging:**
- Induction 5-6 logs
- Casing collar locator log
- Magnetic susceptibility log
- Nuclear magnetism log

D. **Sound or Acoustic logging:**
- Acoustic, velocity, sonic logs

E. **Nuclear logging:**
- Gamma ray log
- Neutron log
- Radioactive tracer log
- Densilog or gamma-density log
- Cemoton log
- Activation or oxygen log
- Salinity-chlorinilog-spectral logs
- Flowing neutron log
- Spaced neutron log

F. **Mechanical logging:**
- Automatic drilling time log
- Hole deviation or directional surveys
- Caliper-resistivity dipmeter log
- Caliper or hole-size logs
- Mud log
- Sidewall cores
- Fluid tester

G. **Temperature logging:**
- Cement location log
- Formation logging
- Gas and fluid-location logs

H. **Photographic logging:**
- Downwell camera
- Photoelectric water flow location log

I. **Sonar logging:**
- Sonar caliper log

J. **Chemical logging:**
- Mud analysis log.

ists and highly trained engineers, and every major company maintains a staff of log analysts. In fact, there are now so many log analysts, devoting their entire time to evaluation of logs and logging that a new Society of Professional Well Log Analysts was organized in Tulsa in late 1958. Its membership of 100 technical people are located in most of the oil-producing countries of the world.

The attached tables give a broad picture of well logging. Table 3 classifies tools in 10 categories according to basic techniques. It may be noted there are about 40 methods for obtaining information from a borehole.

Table 2 pictures the chronological introduction of basically new logging tools, methods, and inventions. Note the rapid development of new devices since 1950.

Table 1 surveys the predominant logs, curves, and devices, and shows their uses and applications. Note that no single method provides all of the desired information. This explains how so many diverse logs may be run on an important wildcat well.

The modern trend in logging is to use carefully selected combinations of logs or methods designed to obtain maximum information for existing hole conditions and characteristics of the formations to be investigated. The selection, in itself, sometimes becomes a task since all of the information is desired at a cost that is not excessive. In 1927 there existed only an empirical and qualitative method, but today the analyst has access to many quantitative and mathematical methods to vastly improve his interpretation of log data.

Recommended Logging Programs

Logging programs are specifically designed to fit local conditions and are planned with due consideration of: (1) hole conditions, and (2) nature of the lithology.

Hole conditions. Specific log combinations are used for: (1) fresh muds, (2) salt muds, (3) cased holes, and (4) empty holes (cable tool, air, or gas drilled). Most fresh-mud log combinations are inefficient in salt muds. Only nuclear and electromagnetic types of logs can be used in empty holes. Only nuclear logs can be used in cased holes, but many of these can also be used in fluid-filled holes.

Nature of the formations. After selecting the optimum log combination for hole conditions, attention is given to the nature of the lithology. The controlling factor is principally the porosity range of the beds, which indirectly controls the range of resistivity. Certain resistivity logs are most efficient in low resistivities, others are most efficient in high resistivities.

Certain porosity determination devices and logs are superior in low porosities, whereas others have greatest efficiency in high porosities. Since porosity is indirectly related to "softness" or "hardness' of formations, resistivity and porosity are often classified as being adapted to "soft," "hard," and "intermediate" beds.

An excellent table for selecting an appropriate logging program is presented on page 2 of "Log Interpretation Charts," available through Schlumberger.

Wildcat opens new territory in Texas

A NEW OIL FIELD more than 30 miles from any other production has been found in far-southwestern Texas' Kinney County. It is the first commercial production in that county or bordering areas of surrounding counties, in a vast sparsely explored region of the state.

Discovery well is a small pumper with production from the Edwards-Glen Rose section of Lower Cretaceous age. It was drilled by J. P. Kiel, in conjunction with King Oil Co. of Wichita Falls, Tex. Location is on their Joe N. Kerr, Jr., lease, in the large Meliton Valadez Grant. It is 6 miles west of Bracketville, and less than 10 miles from the Val Verde county line.

Pay zone is perforated at 1,750-60 ft. Production on the pump has ranged from 21 to 42 bbl. per day. It is an asphaltic crude with gravity of 36°.

Although the present pay zone has been identified as either Edwards, or Glen Rose, the well also had good gas showings in basal Cretaceous at 3,800 ft. and at 3,980 ft., bottom of the hole. A dual completion may be attempted later, taking in the other pay horizons.

The well had oil saturation and good shows in a sandy lime zone in the Kiamichi (Edwards) at 1,270 80 ft. A strong fresh-water flow encountered in the overlying Georgetown formation at 888 ft. was giving much trouble while drilling (with cable tools) through this horizon, and no test was made. The oil showed up on the pits, and after an overnight shutdown, the well filled up and flowed about 6 bbl. of oil with the water.

Kinney County, located off the southwest side of the Edwards Plateau region, is on a southwesterly projection of the Balcones and Luling-Mexia fault systems.

A REMOTE-WILDCAT oil discovery in productionless Kinney County, far-southwestern Texas, stands out conspicuously in vast sparsely explored region of the state.

Good well completed in Texas' Zavala County

A high gas-oil ratio well has been completed by W. L. Steeger in Zavala County, Southwest Texas, as the discovery producer in the Comanche Creek area.

The well, 1 Roy Erskine, in the William Hotchkiss Survey, flowed 19 bbl. of oil with 600 M.c.f.d. of gas through 14/64-in. choke. Pressure gaged 850 psi. Gravity of the oil is 28.9°. Pay is perforated at 2,472-82 ft.

Palacios has one of best discoveries

One of the best wells in the prolific Palacios field, in Matagorda County, Texas Gulf Coast, has been completed by Pan American Petroleum Corp. at its 1-B A. D. Bohuslav oil discovery.

Flow of the well through ¼-in. choke was gaged at 528 bbl. per day from its deeper Frio pay at 9,030-38 ft. Flowing pressure was 1,600 psi.

Testing now is under way in a shallower pay at 8,991-99 ft. for a dual completion.

The new well is 8 miles north of Palacios at the northern end of the widespread multiple-pay gas-condensate and oil field.

Canada Completions, May 1960

	ALL WELLS								WILDCATS						
	Total	Oil	Gas	Dry	Service	Footage	Cum. 1960 wells	Cum. footage 1960	Total	Oil	Gas	Dry	Footage	Cum. wells 1960	Cum. footage 1960
Alberta	64	39	14	11	0	392,668	629	4,029,959	11	0	4	7	62,435	172	1,096,209
Saskatchewan	40	31	2	7	0	163,958	183	755,022	7	3	0	4	29,236	39	178,864
Manitoba	1	1	0	0	0	2,002	21	46,159	0	0	0	0	0	5	13,292
B. C.	6	3	0	3	0	31,644	79	384,885	2	0	0	2	13,399	43	221,548
N. W. T.	1	0	0	1	0	785	13	39,147	1	0	0	1	785	13	39,147
W. Canada	112	74	16	22	0	591,057	925	5,255,172	21	3	4	14	105,855	272	1,549,060
Ontario	9	1	2	6	0	20,080	103	164,046	..	..	..	..	.....	....	.....

RANKIN COUNTY joins the expanding list of South Mississippi's oil-producing counties with opening of state's third Lower Cretaceous field to be found this year.

South Mississippi adds third Lower Cretaceous discovery

THE NEW Puckett field in southeastern Rankin County gives South Mississippi its third significant Lower Cretaceous discovery in a year dominated by continued active exploration and development of the younger Tuscaloosa sands of Upper Cretaceous age.

Its discovery marked a small extension of the trend of the main part of the trend of Lower Cretaceous fields northwestward into the 40-mile gap between it and the more or less isolated Bolton field, in Hinds County.

Except for the old shallow Jackson gas field, now virtually exhausted, there has been no other production of any kind in the county. Puckett is about 25 miles southeast of the Jackson area, adjacent and partly underlying the city of Jackson. It is slightly less than 10 miles west of Boykin Church, in adjoining Smith County, nearest oil production, and a little more than 10 miles from St. Martinville, in Simpson County, on the south. Both Boykin Church and St. Martinville are Lower Cretaceous fields.

Discovery well at Puckett was drilled by Gulf Coast Drilling & Exploration Co., Inc., with L. A. Wyatt and Rees R. Oliver as joint operators. It was tested for a dual completion in both the Washita-Fredericksburg and Paluxy zones. Only the upper (Washita-Fredericksburg) is to be produced for the time being. It is perforated at 8,615-22 ft. and tested good for 264 bbl. of 38.8°-gravity oil daily, flowing through ¼-in. choke. Flowing pressure was 300 psi.

Paluxy sand, perforated at 9,328-35 ft., tested 1 M.M.c.f. of gas and 34 bbl. of 57.8°-gravity oil daily. Flow was through ⅛-in. choke with 3,250 psi.

Production from the upper zone is reported to have declined sharply since completion.

The well was drilled to 12,268 ft. in the Hosston, basal Lower Cretaceous zone. No commercial shows were indicated in the lower zones.

Location is on the operator's R. H. Allen lease, in 13-3n-5e. This is slightly more than 2 miles northeast of Puckett town site.

Other Lower Cretaceous fields opened this year are Cypress Creek, in Wayne County, and Kokomo, in Walthall County. Both were April discoveries. The former is oil productive from the Rodessa horizon. The other has dry gas from Paluxy sand.

Oklahoma action sets fast pace

OKLAHOMA exploratory and development activity continues brisk in all sections of the state.

Northwest. The big gas reserves in northwestern Oklahoma's portion of the Anadarko basin continue to grow. In Texas County, Hamilton Brothers 1-13 Hicks, C NW SE 13-5n-12eCM, flowed 5,210 M.c.f.d. from Morrow at 6,064 ft.; 7,304 M.c.f.d. at 6,039 ft., and 12,800 M.c.f.d. at 5,423 and 5,432 ft. Cities Service Oil Co.'s 1 Hier-A, C SE NW 21-5n-15eCM, second well in a new field in Texas County, flowed 60,000 M.c.f.d. at 6,128-38 and 6,148-50 ft.

New production was tapped in Beaver County recently at Vickers Petroleum Co. 1 Neufeld in C SW NE 11-1n-21eCM. This well flowed 2,000 M.c.f.d. from perforations in the Morrow Pennsylvanian at 7,776-98 ft. From lower Morrow at 7,834-58 ft. it flowed 1,630 M.c.f.d.

Stekoll Petroleum Co. extended a new producing area southwest of Six Mile field with upper Morrow production at 1-35 Laughrin in C SW NE 35-3n-23eCM. The well flowed 40,000 M.c.f.d. and 280 bbl. condensate from perforations at 7,111-22 ft. The field pay here is lower Morrow. From that zone at 7,524-37 ft. the well flowed 16,000 M.c.f.d. and 320 bbl. condensate.

In Woodward County, Sun Oil Co. added the third well at Southeast Woodward field. The 1 Guthrie, 23-22n-20w, flowed 22,500 M.c.f.d. from Morrow sand at 8,236-46 ft.

Central. Kingfisher County development continues its lead over this section of Oklahoma. East Hennessey, North Dover, and North Okarche fields all have grown in the past few weeks. Manning and Meramec Mississippian rocks are getting the play at Hennessey and Oswego and Manning at Dover field. Jones and Pellow opened production in the Manning and Meramec at a wildcat 1 mile east of East Hennessey field. Texaco Inc., Cleary Petroleum Co., and Big Chief Drilling Co. opened Oswego production in East Lincoln field.

Pure Oil Co.'s 1 Valouch in SE NW NW 17-8n-2w, South Norman field opener, Cleveland County, is a dual discovery in Wilcox and Tulip Creek Ordovician. The well flowed 7,100 M.c.f.d. from the Wilcox at 8,065-67 ft. It flowed 4 bbl. condensate per hour from this zone, also. From Tulip Creek at 8,358-66 ft., flow was 107 bbl. condensate per day on 14/64-in. choke.

Southern. More Hunton Siluro-Devonian production was tapped southwest of Wilson-Joiner City field. Frankfort Oil Co. 1 Enloe, C NE SW 32-5s-3w, swabbed 72 bbl. of oil per day from perforations at 8,742-52 and 8,800-16 ft. in the Chimney Hill zone. Woods Petroleum Co. 1 Wilson, NE NE 20-3n-9w, northwest of Southeast Sterling field, flowed 11,500 M.c.f.d. from 7,033-55 ft.

Exploration, development for SW Alberta set to pay off

LITERALLY millions of dollars of oil and gas exploration and development-company money has been expended on operations in the extreme southwest corner of Alberta.

When large-scale gas export from this province to the western United States gets under way this same region—from Lookout Butte on the Alberta-Montana border as far north as Savanna Creek, some 60 miles south-southwest of Calgary—will be a major supplier of pipeline gas to the export projects. The area is a current hot spot in exploration both north and south of the international boundary.

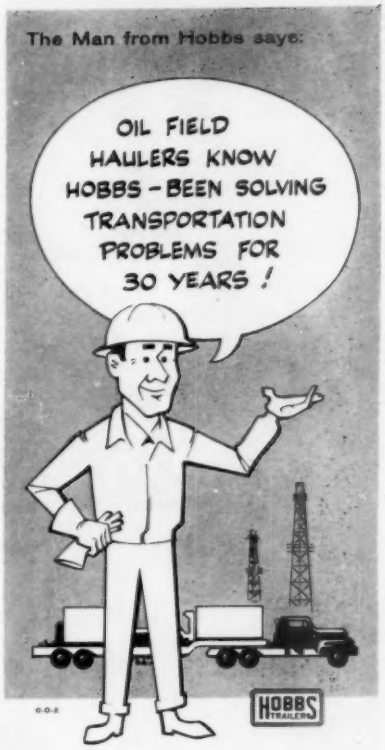
Vast reserves. Encompassing such renowned gas fields as the presently producing and very prolific Pincher Creek field, along with Waterton Park and Savanna Creek, proved gas reserves are tabbed at almost three trillion cubic feet. As of December 31, 1959, Pincher Creek was rated with reserves of 1,450 billion cubic feet; Savanna Creek had 550 billion cubic feet; and Waterton added 750 billion from the Mississippian and 200 billion from the Devonian. Add to this sizable volume the unknown but potentially large reserve of Lookout Butte and we are definitely on the high side of three trillion.

Interest high. Interest in the area is high and most recent staking on the Canadian side of the potential gas-producing area was at the northern end of the proved limits of the Waterton Park field and was by a new operator in the area. Pan American Petroleum Corp., rumored to be highly interested in the region's possibilities when its land deal with Canadian Colliers was announced in late April, completed its land arrangements last week and has staked a 14,000-ft. Devonian probe. Meanwhile, there are four field development wells and a pair of wildcats under way in the general area, as well as a wildcat testing for gas in southeastern British Columbia. Also, Superior Oil of California is rumored to have spotted a wildcat on strike with Pincher Creek and Lookout Butte gassers just 4 miles south of the Canadian border.

Pan Am's first. Pan American's new drilling project that marks this firm's entry in the area, is its Pan Am Byron 7-27-6-3 A-1 Waterton test, on LSD 7, 27-6-3w5. It lies 3½ miles north-northwest of the Shell 6-12 Carbondale Devonian gas discovery well at the north end of Waterton field and is actually just 1½ miles north of the presently designated limits of that producing area. The deep test well is situated on the rights that Pan American bought from Canadian Colleries & Associates for cash bonus of $450,000. The coal company and its partners also were granted a 12½% royalty on the rights as well as a 37½% carried working interest. This test will earn Pan Am its interest in a four-section block and give it the option to drill a second venture to acquire an interest in the entire 18,960 acres of lease rights involved in the agreement. The company has recently acquired additional acreage in the general area but details of these deals have not been reported. Drilling contract has not been awarded as yet and no expected start date has been announced.

Other workers. The gas play's other current drillers include:

Shell Oil Co.'s 4-25 and 5-17 Waterton Park field-development drillers at the extreme south end of the producing area and on the southeast corner of the field. Waterton field



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stretches into eight separate townships, is 24 miles in length—running in a northwest-southeasterly direction almost parallel with Pincher—and is 6 miles wide at its widest part. Neither the north nor south boundaries of the producing area have been delineated. Average cost per well, and there are 11 gas wells and 1 oil well along with a dry hole inside the field limits, runs to about $800,000. Shell & Texaco Exploration Co. are the major acreage holders in the field.

Amerada finds oil at Rowley, Alberta

Mississippian oil is reported at an Amerada Petroleum Corp. wildcat in the Rowley district of southern Alberta.

Recovery of 2,400 ft. of clean oil is reported on a pair of drill-stem tests covering a 128-ft. interval at 4,335-4,471 ft. Location is 19 miles due north of Drumheller and 2 miles southeast of Rowley. The well is the 11-15 Rowley on LSD 11, 15-32-20w4.

Saskatchewan. Joe Phillips Ltd. has two oil finds in the general Weyburn area of southeastern Saskatchewan. The 10-3 Weyburn on LSD 10, 3 6-12w2 flowed 202 bbl. of oil per day. The 12-9 well on LSD 12-9-6-12w2 swabbed 35 bbl. of oil per hour. Both are Midale Mississippian producers.

Pincher Creek well nears completion

British American has a development driller nearing completion in the famous Pincher Creek field. At Lookout Butte, British American is also making hole at a followup to its significant discovery well. This test lies 1½ miles northwest of the pool discovery and is 6 miles south of the defined limits of the Pincher Creek field.

Shell will be drilling the most southerly Canadian test in this program with its 7-20-1-28 Chief Mountain wildcat scheduled for an early start. This test is located 3 miles north of the Montana State border and that same approximate distance south of the B. A. Lookout Butte discovery This venture will be drilled as a Mississippian test to around 12,900 ft. by a Brinkerhoff Drilling Co. rig.

The pioneer of exploration to the west of Pincher Creek, Shell Oil Co. has a wildcat nearing completion close to Coleman town about 16 miles northwest of the northern end of the Waterton Park field. This test, Shell Calalta Coleman 7-35-8-4, was originally

scheduled as a 13,000-ft. probe of the Mississippian. Rumors have the well into the Mississippian. The operator is noted for its completion methods, core, log, set casing and test, and this makes for the drilling of quite successful tight holes. Thus no discovery details have yet been bandied around. However, it is anticipated that a Mississippian contact has been made. Contents of the zone are not known.

Across a few mountains in the southeastern sector of British Columbia the California Standard Co. is making hole at its Fording Mountain D-61-L wildcat. This driller lies 28 miles northwest of the Shell Coleman well and is about 17 miles north of Natal town.

The United States approval of gas import from Canada for the northwestern United States and the California markets can't come too soon for the Canadian operators in this region of Alberta and British Columbia for it will be a few years even after export starts before they will be in the "black" on this gas play.

Geologists discuss natural gas

High-ranking authorities on natural gas, including some of America's leading geologists, will address members of the Southwestern Federation of Geological Societies at the group's third annual meeting, October 12-14, 1960, in Abilene.

The tentative convention program, announced this week, includes papers by well-known university professors and members of consulting firms.

R. C. Moore of Lawrence, Kans., president of the American Geological Institute and a professor of geology at the University of Kansas, will speak on "The Permian System of Texas."

B. W. Beebe, Boulder, Colo., independent geologist, will speak on "Natural Gas in North America."

S. P. Ellison, Jr., chairman of the geology department at the University of Texas, will discuss "Geology of North Central Texas."

Members of the firm of DeGolyer & MacNaughton, Dallas consulting firm, will present a paper on "Natural-Gas Potentialities in the Southwest." This paper, described as a "team effort" by the firm, will give an evaluation of natural-gas reserves in this section of the country.

Otto Wetsel of Dallas, member of the firm of Purvin & Gertz, will speak on "Physical Attributes of Gaseous Hydrocarbons."

Specific areas and fields in the Southwest will be discussed by other speakers to be announced later.

Headquarters for the meeting, which also is designated a regional meeting of the AAPG, will be the Wooten Hotel. Technical sessions, scheduled Thursday and Friday, October 13 and 14, will be held in the Paramount Theater, next door to the hotel.

Texas' Scurry hits Strawn

Strawn lime is proving productive in a new wildcat discovery by Drilling & Exploration Co., Inc., in northwestern Scurry County. in West Texas.

Discovery well, 1-A Jones, is being completed pumping 165 bbl. of oil with 145 bbl. of water per day. Its pay is perforated at 7,810-20 ft.

Location is 1½ miles southeast of Fluvanna. It is 2 miles west of Varel field, nearest production.

Good oil recovery for Ohio well

A good oil recovery has been made by Carl Smith in testing his 13 Fee in Tilton pool, Licking County, Ohio. The well made 150 bbl. of oil in the first 24 hours after fracturing with Clinton sand logged at 2,941-58 ft. and 2,974-89 ft. Before fracturing, it made 10 bbl. of oil per day. Location is in Section 22, in southeastern Fallsbury Township.

In a 4-hour test after fracture, S. E.

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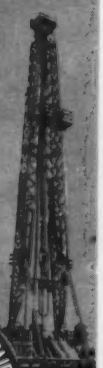

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Brown 1 Donald Colopy, 4 Quadrant, Howard Township, Knox County, flowed 40 bbl. of oil with gas volume of 619 M.c.f. Clinton sand was logged at 2,664-94 ft. and had 1 bbl. of oil and 459 M.c.f. of gas, natural.

Oil production of 75 BOPD with 258 M.c.f. of gas after fracture was reported by Atlas Oil Corp. on completion of 1 Herman Volkman, Section 17, Lake Township, Stark County. Clinton sand was logged at 4,350-4,412 ft. and had a show of oil and gas, natural. Shut-in rock pressure was 1,100 psi.

Pennsylvania has important find

A SIGNIFICANT discovery was made on the Laurel Hill anticline in Westmoreland County, Pennsylvania. Boswell Lumber 1, drilled by Peoples Natural Gas Co. and Snee and Eberly, a combined venture, was completed for 9,115 M.c.f.d., natural, at a rock pressure of 2,799 psi. in 24 hours.

In the Onondaga chert, 116 M.c.f.d. was found at 7,460 ft. The Oriskany was topped at 7,541 ft. and a large flow of gas was encountered in the Oriskany between 7,580-85 ft. This wildcat is located about midway between the Felmont Oil Co. discovery of last March and Johnstown field to the southwest on the same anticline. A heavy lease play has been under way along this anticline since the first of the year from the southern state line to Sullivan County near the northern border of Pennsylvania. These two discoveries should stimulate drilling for a number of miles along the anticline. The Pennsylvania Game Commission has just announced 1,185 acres for lease just south of the Felmont discovery in Westmoreland County. Sealed bids were accepted up to June 16.

Bids opened. Bids were opened May 31 on 22,027 acres of Commonwealth of Pennsylvania, Department of Forests and Waters land in Clinton, Tioga, and Porter counties, of which 16,977 acres were leased. The Pennsylvania Game Commission has just leased 1,580 acres in Bedford and Blair counties.

Boone Mountain. In this field, development has continued as far southwest as DuBois where locations have been made inside city limits.

Other news. The wildcat in Westmoreland County, Hillbush, is drilling at 3,741 ft. Benedum-Trees' wildcat in Washington County is moving in rig. A rank wildcat has been located just north of Franklin in Venango County. The well is to be drilled on the Burkhardt farm by Engles.

Illinois basin reports wide success

WIDESPREAD exploratory and development success is reported in the Illinois basin. All three states in the area are represented in this drilling action.

Illinois. In Hamilton County, 5 miles east of Thompsonville, C. E. Brehm and Indiana Farm Bureau have completed the 7 Davis-Harris in SE SW NE 9-7s-5e, flowing 170 bbl. per day after fracture in the Aux Vases sand at 3,263-88 ft. The first well in this prolific producing area was completed in 1953 by Brehm. Subsequent development has netted wells with gages up to 1,300 bbl.

In Effingham County, E. M. Self is testing in Benoist sand at 2,300-6 ft. at the 1 Rosa Yates in NE NE NE 29-6n-5e, 1 miles west of Mason. This is the second well in the area.

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Recovery on a drill-stem test at 2,296-2,306 ft. was 1,040 ft. of gas, 320 ft. of oil.

Also in the same county, Jet Oil Co. completed 3 General American Life Insurance Co. in NE SW SE 17-6n-7e, 7 miles southeast of Watson. This well pumped 61 bbl. of oil per day from McClosky lime at 2,856-62 ft. This is the company's fifth well in the area, opened in 1958 at a stepout discovery.

In Lawrence County, Carl Phillips 1 C. Lucas, NW NE NE 20-3n-12w, is a new-pay discovery for the area 1 mile south of Bridgeport. Recovery on drill-stem test in McClosky at 1,892-1,911 ft. was 1,200 ft. of oil. Casing is set for a test at 1,902-4 and 1,907-10 ft.

In Schuyler County, Pal Oil Co. 1 Walker in NE SW SE 9-2n-2w, 4 miles northwest of Rushville, was completed for 30 bbl. of oil per day from Silurian at 674-77 ft.

Kentucky. In Muhlenberg County, Luther McIntosh set casing at 1 D. D. Malone to test the Bethel sand at 1,836-52 ft. A drill-stem test at 1,835-52 ft. got 1 M.c.f. of gas, 60 ft. clean oil, 120 mud-mixed oil and 35 ft. oil-mixed mud. This well is 4 miles southwest of Graham.

Indiana. In Gibson County, Wausau Petroleum Co. et al. completed the 1 C. W. Maxam in SE NW NE 27-2s-10w, 3 miles southeast of Princeton, for 20 bbl. of oil per day on the pump. Production is from Jackson sand at 1,658-60 ft.

In Posey County, Inland Producers Co. is swabbing at 1 Wm. Thompson-State of Indiana in NW SE NE 6-6s-14w, 8 miles northwest of Mount Vernon and 1 mile east of Maunie. Testing is in Tar Springs at 2,268-73 ft. A drill-stem test at 2,263-74 ft. got 170 ft. of gas, 290 ft. of clean oil and 15 ft. oil-mixed mud.

New Mexico twin well produces good pay

A well drilled as a twin to Pan American Petroleum Corp.'s recently completed Morrow gas-discovery well on its West Tonto Unit in southwestern Lea County, New Mexico, has been completed as a good oil producer in the shallower Permian-Seven Rivers horizon.

The new discovery well was drilled by William and Edward Hudson as their 1-18 Federal. It flowed 648 bbl. of 33°-gravity oil per day through 20/64-in. choke, registering 360 psi. on the tubing and 120 psi. on the casing.

Its new pay zone is perforated at 3,259-63 ft. with top of the Seven Rivers at 3,220 ft. from elevation of 3,636 ft. Its good flow follows a 3,000-gal. acid treatment.

The same operators already have confirmed their discovery with their second well, 2-18 Federal, a location southeast of their 1-18 Federal discovery. It flowed 152 bbl. of oil on a 16-hour gage through 22/64-in. choke. Its pay is perforated at 3,247-49 ft. and 3,252-56 ft.

The new area with the one Morrow gas well and the two Seven Rivers oil wells is 15 miles south of Maljamar. It is several miles west of the original Tonto field. Specific locations are in 18-19s-33e.

Oklahoma's Manning pays

Manning sand has proved productive in Jones and Pellow Oil Co.'s new well (1 Crossley) in the north Dover area of Kingfisher County, Oklahoma.

Testing the Manning sand, perforated in two intervals at 6,909-20 ft. and 6,929-41 ft., follows tests of the deeper Meramec zone, which, in open hole, also showed for oil production.

From the lower Manning perforations, the well swabbed 25 bbl. daily after acidizing. The upper zone before treatment swabbed 81 bbl. in 14 hours. Before acidizing, the Meramec pay made 2 bbl. of oil hourly.

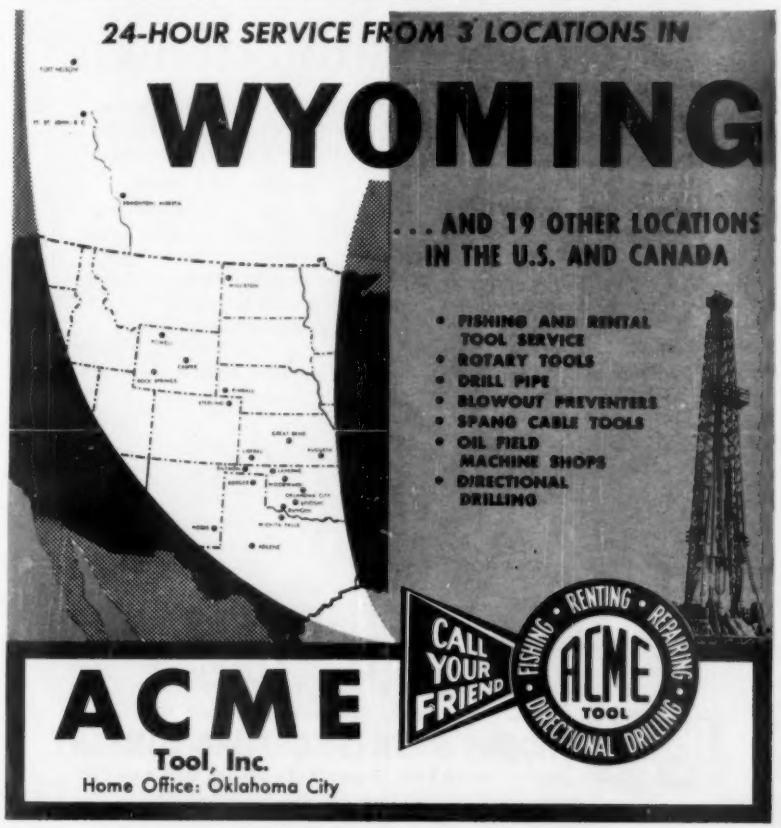
Remote Oklahoma wildcat is Tonkawa gas strike

In western Woods County, northwestern Oklahoma, Ashland Oil & Refining Co. has a significant lower Tonkawa Pennsylvanian gas discovery indicated at 1 Gerloff in C NW SE 27-27n-16w. Location is 12 miles southwest of Yellowstone field and 6 miles northeast of South Edith field.

Drilling continues after gas was found in the lower Tonkawa at 4,801-9 ft.

Panhandle discovery gets Morrow sand confirmation

A Shell Oil Co. well in east-central Texas County in the Oklahoma Panhandle is a confirmation discovery for the 1-8 Balzer, recent Morrow and Mississippian gas discovery. The 1-9 Balzer in C NE SW 9-3n-17eCm, flowed 2 M.M.c.f.d. and 12 bbl. condensate per day on 12/64-in. choke. Morrow sand was 6,453-56 ft. This test is 9 miles south of Hooker and is the east offset to the previously mentioned discovery.



Unproductive Texas salt domes target of wildcatting program

New wildcatting is getting under way or planned on three more of East Texas' long list of still unproductive "inland" salt domes.

Furtherest along is a Woodbine test on the southeast flank of Brooks salt dome, 5½ miles west of Bullard in southwestern Smith County. It is being drilled by John G. Voight on his Annie Brooks Alexander lease in the Pedro Ellis Bean Survey.

At Grand Saline dome, in northeastern Van Zandt County, Seymour G. Hootkins and Texall Exploration Co. are drilling at their 1 Earl B. Persons, in the Samuel Bell Survey. This is set up as a 7,000 ft. test with the Paluxy, or possibly the Rodessa, as the objective.

Texaco Inc., is reported to have location for a 14,000-ft. Smackover test off the flank of the large Palestine dome, 5½ miles southwest of Palestine, in Anderson County.

On the already productive Hainesville dome, just west of Hainesville, in south-central Wood County, a 15,000-ft. Woodbine test started more than a month ago, now is down below 8,800 ft. This test, being drilled by Trice Production Co. and F. R. Jackson, is 2 miles north of British-American Oil Producing Co.'s discovery, and so far only productive well on the dome.

British-American's well was completed originally in July 1956 with production from Woodbine sand at 9,217-47 ft. It was good for 259 bbl. of 42°-gravity oil per day through chokes. It had been drilled to 11,490 ft. Since then, it has been reworked and completed in the shallowed sub-Clarkesville zone at 8,912-22 ft. In this completion it was rated good for 6,500 M.c.f.d. of wet gas, open-flow, with a recovery of 150 bbl. of condensate per M.M.c.f.

The new deep test, 1 Walter W. Pool Unit, in the William Hendricks Survey, is the second for Trice and Jackson on the dome. Their first test, 1 A. C. Wood Estate, in the Peter Tidwell Survey, was dry at 11,220 ft. Its location was nearly 2 miles northeast of the current operation.

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Remote Texas wildcat flows Wolfcamp gas

A 15,000-ft. wildcat in northern Terrell County, 20 miles southwest of Sheffield, flowed 5,100 M.c.f.d. during tests of the Wolfcamp Permian. It is Sinclair Oil & Gas Co. 1 Alma H. Poulter in Section 21, Block 1, TCRR Survey, 5 miles northwest of Brown-Bassett field.

The test was made at 6,254 ft. Bottom is now at 6,320 ft. Operator is running 9⅝-in. casing. This wildcat is slated to 15,000 ft.

East Texas discovery is being confirmed

Recent discovery of Southeast Fruitvale field in Van Zandt County, East Texas, is being confirmed in one of three zones in which the initial well was completed.

The first well, drilled by R. J. Caraway and Pan American Petroleum Corp. and completed last January, proved productive of oil from Upper Rodessa sand at 8,184-94 ft. and Lower Rodessa sand at 8,286-93 ft., and gas and condensate from the Cotton Valley at 10,522-32 ft.

The new well, drilled by Caraway for himself and Pan American as interest-holder, is completed only in the Lower Cretaceous zone of the discovery well. It failed to have the porosity in the Upper Rodessa which the discovery well had. It was not drilled to the Cotton Valley. Its total depth

is only 8,377 ft. as against the 13,563-ft. depth of the first well.

The Lower Rodessa pay of the second well, 1 Sprague-Goforth Oil Unit, is perforated at 8,273-82 ft. It flowed 192 bbl. of 45°-gravity oil per day through 11/64-in. choke with pressure of 775 psi. Discovery well flowed 399 bbl. per day through ¼-in. choke from that zone. The wells are 1,330-ft. offsets.

Devonian hit in West Texas' Dawson

NEW Devonian production has been found in a deep wildcat 1¼ miles southeast of Mungerville field, in western Dawson County, West Texas. Mungerville field is productive from the Pennsylvanian. It is 9 miles west of Lamesa.

Devonian discovery well is Ard Drilling Co.'s 1 J. W. Dubose, which flowed 504 bbl. of 36.7°-gravity oil per day through 12/64-in. choke. It had gas oil ratio of 85 cu. ft. per bbl. and flowing pressure of 225 psi. Pay was acidized with 1,000 gal.

Hole was drilled to 12,106 ft. in the Devonian, topped at 11,995 ft. Pay is perforated at 12,047-53 ft.

Good indications of production were given in the Mississippian, topped at 11,140 ft. A 1½-hour drill-stem test in open hole at 11,125-11,202 ft. recovered 578 ft. of gas, 10 ft. of oil and 130 ft. of heavily oil and gas-cut mud. A test, open 1 hour, of a lower interval at 11,594-11,641 ft., got 6 gal. of oil, 2,000 ft. of water blanket, and 87 ft. of mud.

Discovery wells

CALIFORNIA

Los Angeles County:
- Union Oil Co. of California and Signal Oil & Gas Co. Union-Signal PE-3, 27-1s-14w. IP 1,200 BOPD, 37°, 26/64-in. choke, 5,000-5,300 ft., 7-in. casing at 5,500 ft. New field discovery about 1 mile south of the west flank of Salt Lake field.

WESTERN CANADA

Alberta:
- Amerada Petroleum Corp.-CPR 1-7 Dalemead, LSD 1, 7-22-26w4. TD 6,223 ft. Mississippian gas discovery.
- Imperial 6-14 Benjamin Creek, LSD 6, 14-29-8w5. Mississippian gas discovery. TD 12,464 ft.
- M&C-D&E 11-3 Killam, LSD 11, 3-44-13w4. Basal Quartz gas discovery. TD 3,150 ft.
- Colorado 13-24 Hamilton Lake, LSD 13, 24-35-10w5. Hamilton Lake oil discovery. TD 3,002 ft.

Saskatchewan:
- Champlin 3-23 Elmore, LSD 3, 23-1-32w1. Frobisher zone oil discovery. TD 4,070 ft.
- Canpet-Sarcee 11-9 North Eureka, LSD 11, 9-32-23w3. Viking sand oil discovery. TD 2,462 ft.

COLORADO

Rio Blanco County, Douglas Creek West:
- Gulf Oil Corp. 1 Dragon Trail-Government, SW SE 16-2s-102w. IP (24-hour open flow), 1,180 M.c.f.d., CP 430 psi., Emery 2,700-2,850 ft., open hole. TD 2,925 ft. Emery gas discovery, new field.

Washington County:
- B. F. Allison 2 MacNeill, OWWO, OTD 5,109 ft. IPP 251 BOPD, "D" sand discovery, new field, TD 5,109 ft.

SOUTH LOUISIANA

Calcasieu Parish:
- Superior Oil Co. 2 Farmers Land & Canal Co., Inc., 18-10s-6w, 1½ miles west of Bon Air field. IP 53.51 BOPD 1,719 M.c.f.d., 10/64-in., 54.6°, GLR 32,128 cu. ft. per bbl., TP 3,110 psi., perf. 10,468-474 ft. TD 10,606 ft. Second well and new pay discovery in new unnamed field.

WEST TEXAS

Kimble County:
- Utex Exploration Co. 1 Fred Mudge, Section 10, Block 4, TW&NG Sur., 10 miles northwest of Junction. AOF 2,650 M.c.f.d., perf. 2,021-27 ft. TD 2,150 ft. New field—West Bolt.

Nolan County:
- Lauderdale & Strawn Drilling Co. 1 Josephine Daniel, Section 2, Blk. X, T&P Sur., 5 miles north of Dora. IPP 84 BO in 12 hours, 42°, GOR 1,100 cu. ft. per bbl., perf. 3,558-62 ft., Tannehill. TD 3,612 ft. New pay in Beckham West Tannehill field.

Winkler County:
- Texaco Inc. 1-B J. A. Thomas, 4 miles northeast of Kermit, Sec. 19, Blk. B-5, PSL Sur. IPP 55 BOPD, 36°, Clear Fork 6,270-82 ft. TD 9,700 ft.

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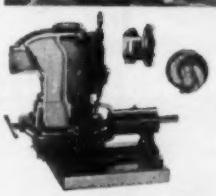

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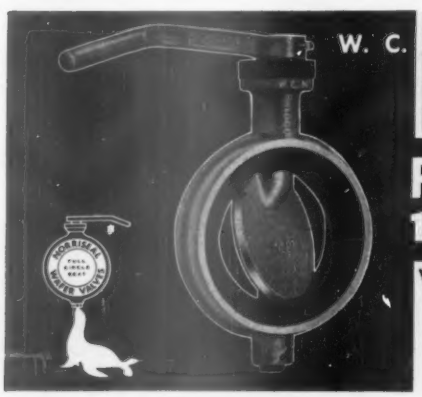
May footage breakdown

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	57,724	.....	.....	.....	.....	.....	.....	.....	.....
Arkansas	62,051	.....	8,285	45,469	.....	3,670	.....	4,841	34,591
California	337,475	.....	31,510	46,405	.....	17,009	.....	11,475	134,995
Colorado	31,022	.....	24,226	41,417	.....	5,200	.....	12,866	81,608
Illinois	92,089	.....	471	118,937	39,358	9,163	.....	373	60,614
Indiana	28,608	.....	.....	33,271	625	1,051	.....	1,937	29,880
Kansas	359,932	.....	58,768	247,730	30,224	67,899	.....	4,990	281,205
Kentucky	49,275	.....	1,451	48,758	974	5,552	.....	.....	7,247
Louisiana	1,076,417	260,310	89,250	632,106	5,352	14,094	14,650	38,848	295,082
North	143,332	.....	51,392	98,360	.....	.....	.....	.....	103,698
South	682,131	202,921	22,338	423,392	5,352	14,094	14,650	38,848	176,643
Offshore	250,954	57,389	15,520	110,354	.....	.....	.....	.....	14,741
Michigan	92,874	.....	8,739	48,044	4,360	17,673	.....	4,912	37,297
Mississippi	193,338	.....	.....	54,399	.....	.....	.....	.....	128,511
Montana	81,566	.....	.....	24,146	.....	5,240	.....	.....	34,603
Nebraska	173,061	.....	.....	98,704	.....	12,110	.....	.....	120,132
New Mexico	335,073	26,803	112,475	36,973	.....	16,205	12,212	.....	100,798
West	40,723	12,600	102,058	.....	.....	6,105	.....	.....	6,181
East	294,350	14,203	10,417	36,973	.....	10,100	12,212	.....	94,617
New York	17,550	.....	.....	2,150	10,000	.....	.....	.....	.....
North Dakota	84,641	.....	.....	35,245	.....	11,959	.....	.....	26,612
Ohio	49,944	.....	52,681	50,490	6,092	.....	.....	3,232	22,144
Oklahoma	592,310	58,681	198,194	233,271	18,345	48,427	13,096	61,591	253,805
South Dakota	.....	.....	.....	.....	.....	.....	.....	.....	1,729
Texas	2,426,103	420,427	212,651	923,997	66,309	122,524	49,720	13,599	976,896
District 1	83,297	8,212	17,831	18,272	2,260	.....	.....	.....	60,943
District 2	121,562	72,721	80,370	72,840	.....	.....	27,617	4,515	91,608
District 3	196,901	58,450	6,010	237,934	.....	.....	11,500	.....	140,456
District 4	87,254	70,966	37,482	131,091	1,269	4,027	.....	3,310	100,726
East	247,143	20,061	1,853	53,357	.....	.....	10,603	.....	119,665
District 7-B	207,483	22,960	13,180	79,188	6,203	16,165	.....	5,774	109,713
West	1,046,844	67,877	23,913	119,709	14,028	70,860	.....	.....	206,232
District 9	287,390	22,917	.....	128,306	39,349	31,472	.....	.....	118,898
District 10	148,229	76,263	32,012	83,300	3,200	.....	.....	.....	28,655
Utah	63,542	.....	6,102	11,077	.....	.....	.....	14,798	30,748
West Virginia	8,340	.....	102,733	13,291	3,876	.....	.....	13,190	.....
Wyoming	153,149	.....	27,881	34,828	.....	19,274	.....	.....	149,291
Total U. S.	**6,366,084**	**766,221**	**935,417**	**2,780,708**	**185,515**	**377,050**	**89,678**	**186,652**	**2,807,788**

	FIELD WELLS			WILDCATS		
	Oil	Gas	Dry	Oil	Gas	Dry
Alberta	265,532	45,588	19,113	.....	25,152	37,283
Saskatchewan	121,369	4,730	8,623	11,590	.....	17,646
Manitoba	2,002	.....	.....	.....	.....	.....
British Columbia	12,832	.....	5,413	.....	.....	13,399
Northwest Territories	.....	.....	.....	.....	.....	785
Western Canada	**401,735**	**50,318**	**33,149**	**11,590**	**25,152**	**69,113**



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VALVES

May's well score in the U. S.

State—	Total completions: Total	Oil	Cond.	Gas	Dry	Service	Footage	Cum. wells 1960	Cum. footage 1960	Cable-tool comp.	D.D.	Active oper.	Wildcats: Total	Oil	Cond.	Gas	Dry	Footage	Cum. wells 1960	Cum. footage 1960
Alabama	5	5	0	0	0	0	57,724	22	229,039	0	0	5	0	0	0	0	0	0	1	2,646
Alaska	0	0	0	0	0	0	0	3	34,703	0	0	7	0	0	0	0	0	0	1	11,315
Arizona	0	0	0	0	0	0	0	6	9,598	0	0	4	0	0	0	0	0	0	6	9,598
Arkansas	42	22	0	3	17	0	156,907	245	914,096	0	0	84	9	1	0	1	7	43,102	60	248,790
California	117	80	0	7	30	0	578,869	543	2,641,704	0	0	87	27	2	0	2	23	163,479	121	661,753
Colorado	40	7	0	7	26	0	196,339	264	1,295,810	0	0	98	21	1	0	3	17	99,674	126	634,577
Florida	0	0	0	0	0	0	0	3	33,807	0	0	0	0	0	0	0	0	0	3	33,807
Illinois	157	42	0	2	90	23	321,005	780	1,568,133	21	4	341	33	3	0	1	29	70,150	192	337,613
Indiana	76	23	0	2	50	1	95,372	365	497,336	48	2	121	28	1	0	2	25	32,868	146	182,492
Iowa	0	0	0	0	0	0	0	1	507	0	0	0	0	0	0	0	0	0	1	507
Kansas	306	134	0	15	147	10	1,050,748	1,308	4,630,693	29	0	381	99	17	0	1	81	354,094	437	1,611,870
Kentucky	101	57	0	1	41	2	113,257	654	913,001	81	0	135	10	5	0	0	5	12,799	77	113,642
Louisiana	293	148	24	15	105	1	2,426,109	1,353	11,298,204	0	0	389	36	1	1	3	31	362,674	198	1,826,368
North	102	51	0	9	42	0	396,782	436	1,721,257	0	0	149	16	0	0	0	16	103,698	83	445,625
South	151	73	19	5	53	1	1,580,369	694	7,174,536	0	0	190	19	1	1	3	14	244,235	102	1,208,848
Offshore	40	24	5	1	10	0	448,958	223	2,402,411	0	0	50	1	0	0	0	1	14,741	13	171,895
Michigan	58	29	0	4	24	1	213,899	295	998,274	0	0	161	15	4	0	1	10	59,882	86	313,205
Mississippi	27	18	0	0	19	0	376,248	299	3,005,347	0	0	55	12	0	0	0	12	128,511	95	929,232
Missouri	0	0	0	0	0	0	0	3	10,104	0	0	2	0	0	0	0	0	0	3	10,104
Montana	27	13	0	0	14	0	145,555	103	477,514	2	1	55	10	1	0	0	9	39,843	47	193,874
Nebraska	73	35	0	0	38	0	404,007	327	1,871,400	0	1	42	24	2	0	0	22	132,242	124	674,130
Nevada	0	0	0	0	0	0	0	2	7,902	0	0	0	0	0	0	0	0	0	2	7,902
New Mexico	128	76	5	22	25	0	640,539	733	3,508,012	37	2	155	22	2	1	0	19	129,215	107	546,202
West	36	12	2	20	2	0	167,667	239	1,059,194	8	1	37	3	1	0	0	2	12,286	22	94,260
East	92	64	3	2	23	0	472,872	494	2,448,818	29	1	118	19	1	1	0	17	116,929	85	451,942
New York	22	13	0	0	2	7	29,700	119	175,364	22	0	13	0	0	0	0	0	0	7	21,646
North Dakota	27	14	0	0	13	0	158,457	127	821,697	0	2	28	9	2	0	0	7	38,571	26	129,112
Ohio	75	23	0	20	30	2	184,583	428	1,060,147	71	0	211	8	0	0	1	7	25,376	24	82,935
Oklahoma	360	181	9	40	119	11	1,477,720	1,578	6,937,759	72	19	714	76	8	2	9	57	376,919	303	1,562,717
Oregon	0	0	0	0	0	0	0	1	2,627	0	0	1	0	0	0	0	0	0	1	2,627
Pennsylvania	0	0	0	0	0	0	0	246	738,120	0	0	61	0	0	0	0	0	0	6	41,595
South Dakota	1	0	0	0	1	0	1,729	15	101,951	0	0	2	1	0	0	0	1	1,729	6	24,848
Tennessee	0	0	0	0	0	0	0	20	16,522	0	0	21	0	0	0	0	0	0	20	16,522
Texas	1,239	667	57	53	438	24	5,212,226	6,509	28,068,428	64	16	1,029	242	19	5	4	214	1,162,739	1,317	6,083,989
District 1	66	35	1	4	25	1	190,815	453	1,287,468	0	0	25	20	0	0	0	20	60,943	155	470,781
District 2	78	22	12	18	26	0	471,233	308	2,049,788	0	3	63	18	0	3	1	14	123,740	73	509,846
District 3	96	38	7	1	50	0	651,251	502	651,251	0	0	96	17	0	1	0	16	151,956	94	831,816
District 4	85	21	9	9	45	1	436,125	472	2,633,352	3	0	61	23	1	0	1	21	108,063	135	749,490
East	99	60	3	1	35	0	452,682	490	2,287,119	0	0	70	24	0	1	0	23	130,268	105	597,265
District 7-B	175	87	6	7	73	2	466,666	948	2,652,609	0	1	78	40	4	0	2	34	131,652	266	778,758
West	318	219	6	5	83	5	1,549,463	1,717	8,644,230	23	3	403	62	8	0	0	54	277,092	285	1,275,484
District 9	251	150	4	0	83	14	628,332	1,216	3,079,265	38	8	97	35	6	0	0	29	150,370	176	642,652
District 10	71	35	9	8	18	1	371,659	403	1,895,520	0	1	136	3	0	0	0	3	28,655	28	227,897
Utah	21	11	0	3	7	0	126,267	117	651,995	0	0	50	7	0	0	2	5	45,546	42	235,815
Washington	0	0	0	0	0	0	0	1	8,520	0	0	0	0	0	0	0	0	0	1	8,520
West Virginia	54	4	0	42	6	2	141,430	312	784,048	50	0	186	2	0	0	2	0	13,190	4	27,058
Wyoming	83	36	0	6	41	0	384,423	394	1,954,984	4	1	165	36	3	0	0	33	168,565	166	852,674
Total U. S.	**3,342**	**1,638**	**95**	**242**	**1,283**	**84**	**14,495,113**	**17,176**	**75,267,346**	**501**	**48**	**4,603**	**727**	**72**	**9**	**32**	**614**	**3,461,168**	**3,756**	**17,439,685**
April 1960	3,043	1,403	99	240	1,203	98	13,668,967	13,834	60,772,233	596	65	4,357	648	51	10	24	563	3,094,688	3,029	13,978,517
Cumulative 1960	**17,176**	**8,082**	**544**	**1,385**	**6,659**	**506**	**75,267,346**	.....	.....	**2,926**	**218**	.....	**3,756**	**338**	**41**	**126**	**3,251**	**17,439,685**	.....	.....
Cumulative 1959	20,032	10,127	506	1,476	7,391	532	83,572,777	.....	.....	.....	.....	.....	3,766	384	53	116	3,213	18,477,442	.....	.....

INSTEAD OF A ROAD

Sikorsky helicopters eliminate costly road building completely. They fly men, materials, equipment right to remote construction sites. Used *both* as a highly maneuverable CRANE and a high-speed TRANSPORT, a Sikorsky helicopter can save months of road building . . . eliminate many right-of-way problems . . . reduce your total costs dramatically. Examples? In New Guinea, an oil company flies a complete drilling rig with men and supplies to jungle locations. Once an eighteen-month operation, the entire job now takes just two months. In Puerto Rico's mountainous upcountry, a helicopter with three two-man ground crews can plant 100 power poles a day, three to four months' work with old construction methods. Savings in costs are from 70% to 80%. Want more facts on Sikorsky Aircraft "off-the-road" economies? Write us today.

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SIKORSKY AIRCRAFT

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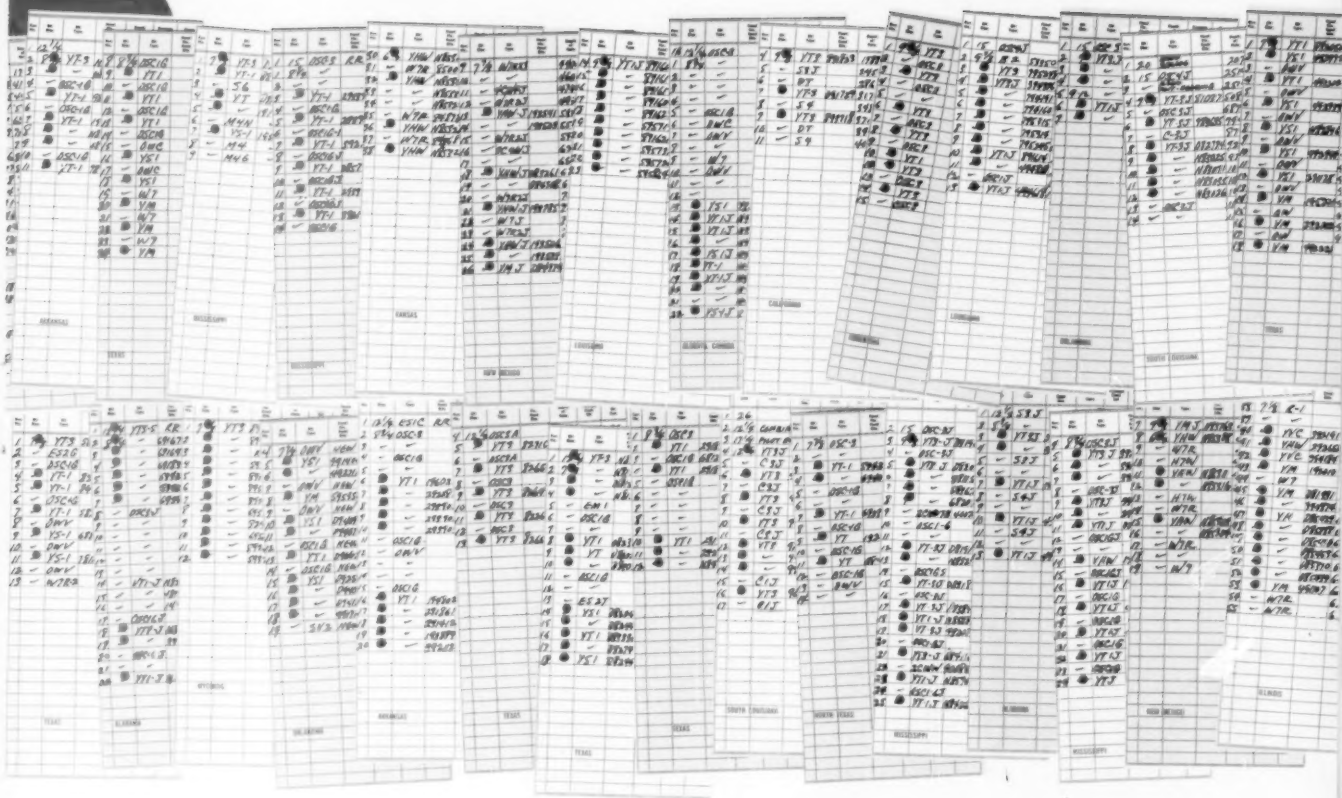
MORE

RIGS ARE RUNNING

MORE

REED BITS



and here's why . . .RECORD AFTER RECORD, FROM FIELD AFTER FIELD, PROVES IT!

The bit records shown above are representative of the competitive job Reed Y bits are doing all over the world.

Most people are using Reed Y bits today because they know that when they put a Reed Y bit in the hole it will do the job and do it right.

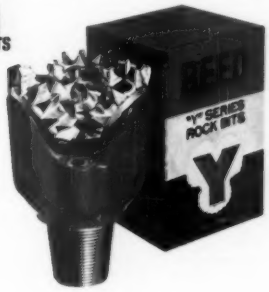
The performance of Reed Y bits in the past year has been so good that we have not, in some cases, been able to supply the quantities that have been demanded by our customers. To remedy this, we have expanded our production facilities and are now in a better position to supply your needs.

An expanded research and development program has enabled us to provide all the most popular sizes and types for immediate delivery and we are adding additional sizes and types on a regular, continuing basis. Each new size and/or type requires many hundreds of hours of research, engineering, and testing. When we release a bit to the field for sale, you can rest assured that it will dig with the best of them.

Run Reed bits on your next well—you'll be pleased with the results.

REED ROLLER BIT COMPANY *Houston 1, Texas* EXPORT OFFICE: 1011 INTERNATIONAL BLDG., NEW YORK 20, N.Y.

GULF COAST, MID-CONTINENT, ROCKY MOUNTAIN AND CANADIAN DISTRIBUTOR FOR MARTIN-DECKER PRODUCTS.



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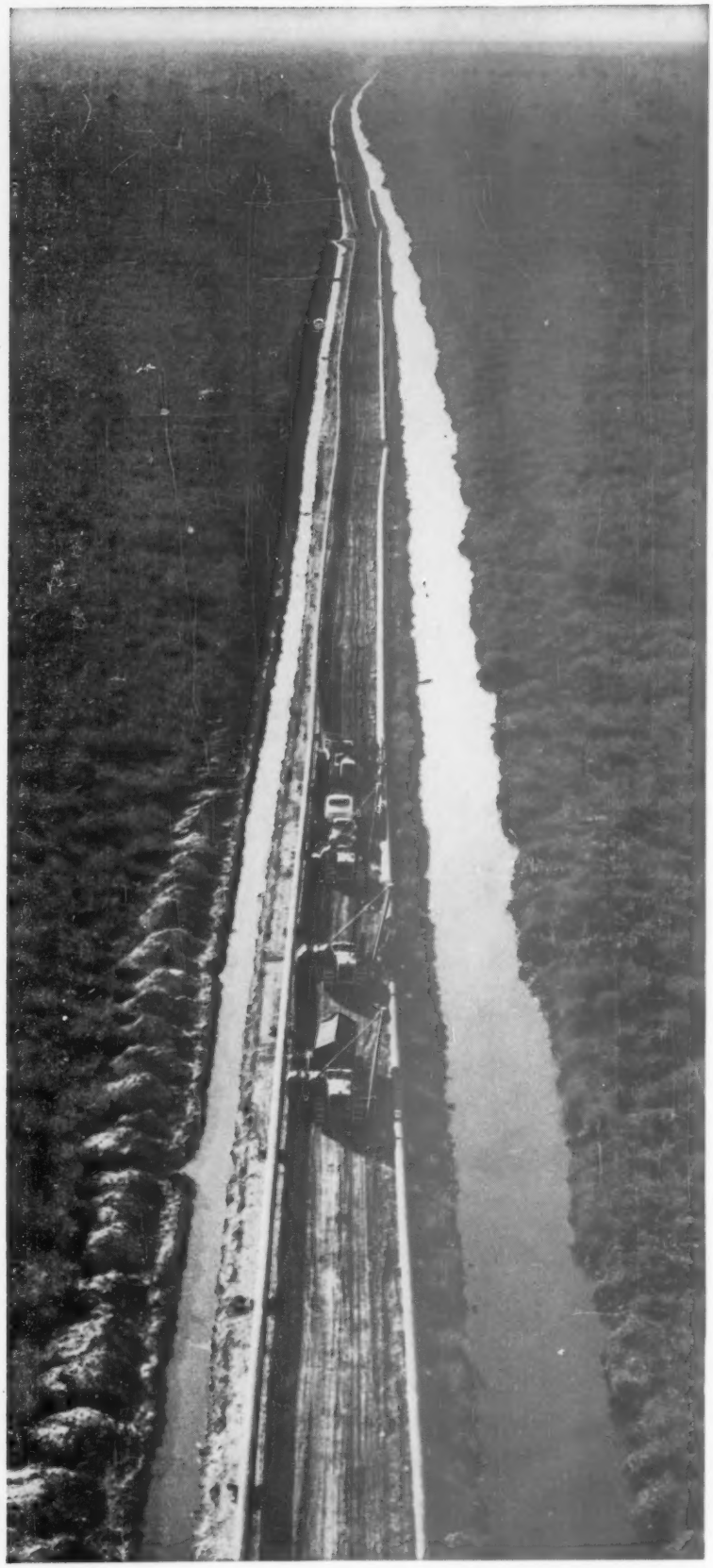
REED'S ROLLIN'



HOW TO CHECK OUT THE TOUGHEST TAPE EVER WRAPPED AROUND PIPELINE

Give it the works . . . that's what Polyken did to its latest development— Extra Strength No. 960

. . . Run it through every tape durability test a laboratory can apply.

. . . Wrap this rugged tape around 30 miles of 24-inch gas line in the swamp water and coral rock of southern Florida. Let an Iranian oil company use it on 200 miles of desert oil line. Put it to work for the Phillips Petroleum Co. in Texas and Canada.

If a tape coating can stand all this and still do the whole job cheaper than hot dope, you've got something special. Something permanent in pipeline protection—Polyken Extra Strength No. 960 Pipeline Roll.

Available at no extra cost.

Applying Polyken protection, as seen above, the Houston Texas Gas and Oil Corporation laid a 1600-mile gas line from Louisiana to Florida. Polyken saved them $500 per mile by way of less men per job and more miles per day. Tape's ready. No primer, no drying or cooling, no fumes or fire hazard. And *low* equipment cost.

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Polyken Sales Division

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D. F. Sears . . . first it was speed, then economy.

Pipeliner's goal: Cut costs

• Time was when the big push was to get pipelines built. Now the pressure is on operational efficiency.

DONALD FRANKLIN SEARS has seen about as many facets of the pipeline business as any man alive—from the furious pace of the Seminole-Cushing days of 1927, through the scramble for pipe during the Big Inch days of World War II, and finally to the rapid expansion of long lines and automation since the war.

As vice president of Shell Pipeline Co. for the past 8 years, Sears has been a working executive whose record of accomplishment is well known and respected in the industry.

There was virtually nothing in Don Sears' early life that pointed the way toward a career in pipelining, except for his study of engineering.

Born in Vermont (Feb. 26, 1904) and reared at Framingham, Mass., he went to Worcester Polytechnic Institute at Worcester, Mass., and took his B.S. in civil engineering in 1926.

During summer vacations he had worked for various engineering firms and, quite normally, took a job in Boston with a consulting engineer specializing in sanitary systems.

Then a college professor who was the brother of a banker for Shell told Sears that Shell's pipeline company out west needed a young engineering trainee.

And that's how a waterworks engineer out of Boston landed in Cushing, Okla., in 1927.

The road up . . . Shell's Ozark Pipeline Corp. was laying lines out of Seminole as fast as it could get them in the ground.

During 6 months in the field Sears helped lay four such lines, two of them completed to Cushing, where they tied into the main line to Wood River, Ill., also undergoing expansion.

The same mad race soon was going on from West Texas to Cushing, and also to Houston, where Shell had decided to build a refinery.

Sears escaped from Cushing to the St. Louis headquarters to serve, first, as assistant to the chief engineer in design and then as chief engineer. His responsibility: Designing and ordering materials for the big expansion in the Southwest.

With this experience and record behind him, Sears moved to Houston in 1930 as assistant general superintendent for gathering lines in Texas, Oklahoma, and Kansas. In 3 years, at the age of 29, he was back in St. Louis as assistant manager of the company, by now known as Shell Pipeline Co. In another 6 years he was the general superintendent and a director.

Then he returned to Houston in 1940 when the company moved its operating offices there.

The road to war . . . It was no surprise that the Petroleum Administration for War tapped Don Sears in 1942 for front-line duty in building the desperately needed long lines for World War II.

As chief of the pipeline section in PAW's transportation division, Sears handled liaison for (meaning to wangle) materials for the Big Inch and Little Big Inch lines.

The high road . . . Following the war, Shell Pipe Line handed Sears a variety of executive assignments that prepared him for the vice presidency he won in 1952.

He handled basic design and economic studies for developing the Basin and Ozark systems from New Mexico eastward, and supervised purchasing and stores department and the company's technological program. Among other things, he prepared the annual budget.

Next, as many Shell officials do, he took his tour of foreign duty. He studied the transportation requirements in western Venezuela for Shell Caribbean and wound up as coordinator of the giant (30-in.) Lightline project from Maracaibo to Cardon.

After 2 years in Caracas, Sears returned to Houston as vice president of Shell Pipe Line with responsibility for operations.

His building days continued. Since 1952 he has directed construction and development that have practically doubled Shell's investment. The Butte pipeline, completed in 1957, opened the Williston basin. The Four Corners pipeline, completed in 1958, opened the Four Corners area to the West Coast. The Delta pipeline, completed in 1959, brought offshore production to Shell's Norco, La., refinery.

The road ahead . . . For the moment, Shell has no new pipelines under construction. But Sears' job is no less challenging.

His assignment: Cut costs. He is doing it with automation.

"The two biggest elements in cost are power and labor," Sears says. "Our basic philosophy on automation is power-level control—keeping load factors as near 100% as possible."

As for labor savings, Sears can point proudly to a record of drastic cutbacks on manpower without firing a person.

The company hasn't hired a regular employe since 1954 but also hasn't laid off anyone since before World War II.

Sears is married and the father of a married son and daughter. A second son was killed in Korea.

Personals

J. W. Braun, superintendent of the chemicals section in Atlantic Refining Co.'s Philadelphia refinery, has been named superintendent of the refining section there. He succeeds **Dr. H. V. Hume,** who has retired after 33 years with the company. **J. B. Clapham** will

BRAUN

CLAPHAM

succeed Braun. Braun has been with Atlantic since 1929. He was technical assistant to the vice president and general manager of manufacturing before being named superintendent of the chemicals section in 1956. Clapham most recently coordinated expansion of Atlantic's wax-manufacturing facilities in Philadelphia. He joined Atlantic in 1938.

E. A. Hooper has been appointed assistant general manager of Marine Pipeline & Dredging, Ltd. He will headquarter in Vancouver, B. C.

T. J. Crutchfield, Permian division compressor superintendent for El Paso Natural Gas Co., has been promoted to division assistant superintendent. **L. G. Sweatt,** assistant compressor superintendent in the Permian division, will succeed Crutchfield as compressor superintendent. **H. H. Pool,** supervisor of compressor maintenance, Permian division, has moved up to assistant compressor superintendent.

James LeBlanc has been promoted to Houston district land man by Trunkline Gas Co. He has been with the company since 1957.

William R. Clark, district geologist in Joliet, Ill., for Natural Gas Storage Co. of Illinois, has been appointed assistant chief geologist.

Charles R. Younts will retire as chairman of Plantation Pipe Line Co., Atlanta, July 1 after 48 years in the petroleum industry. Younts joined Standard Oil Co. (N. J.) in 1919 and has been with Jersey and its affiliates since that time. He became Plantation's first president in 1941 and was elected chairman in 1959. Younts has joined with friends to form Retired Associates to aid nonprofit and charitable institutions.

Noyes Richey, associate professional research chemist with Texas Butadiene & Chemical Corp., has been promoted to section head in the polychemical department.

H. H. Dronberger, formerly manager of Pure Oil Co.'s Toledo refinery, has joined the engineering division of Sumner Sollitt Co. in Chicago. He will specialize in design of terminals and lube-oil blending, packaging, and distribution facilites.

Charles W. Nease, district engineer in Holdenville, Okla., for United States Geological Survey, has been transferred to Oklahoma City as district engineer. **John P. Conray,** petroleum engineer in Oklahoma City, has been promoted to district engineer in Holdenville.

Dr. D. M. Beeson, Jersey Production Research Co., has been named a section head in the chemical research division of Esso Research & Engineering Co. in Linden, N. J. Beeson had been on temporary assignment with Esso Research. The appointment is effective July 1.

H. M. Van Clief, manager of field operations for Honolulu Oil Corp.'s western division, has been elected vice president in charge of the western division. He succeeds the late F. M. Cole (see deaths). Van Clief has been with Honolulu since 1922. He had served as drilling foreman and superintendent of the California division before being named western division manager of field operations in 1957. Van Clief will move to San Francisco headquarters from Taft, Calif.

Dr. Herman A. Bruson, director of research, organic chemicals, for Olin Mathieson Chemical Corp., has been named vice president for research of the chemicals division. In other chemicals division appointments, **J. B. Andrews** has been named administrative services manager; **W. I. Denton,** director of engineering services department; and **Dr. J. V. Karabinos,** director of the organic research department. **Dr. D. W. Kaiser** will be manager of the special chemicals section, organic research department; and **Dr. A. E. Ardis** will be director, polymers research department. **Dr. R. M. Thomas** has been appointed director of the industrial chemicals applications research department. **Dr. C. M. White** will be manager of automotive chemicals section of this department. **Dr. C. W. MacMullen** will be director, special chemicals applications research department.

John T. Sullivan has been appointed market research and development analyst for Goodrich-Gulf Chemicals, Inc.

Darrell G. Warner, engineer with Humble Oil & Refining Co.'s Carter division in Carmi, Ill., has been transferred to St. Elmo, Ill., as production engineer.

B. A. Martin and **R. B. Nesbitt,** section heads in Humble Oil & Refining Co.'s Baytown, Tex., technical division, have been promoted to senior chemical engineers. **T. G. Lipscomb** has been promoted to senior research chemical engineer in the Baytown research and development division.

Dr. R. C. Fox has been named senior research chemist in the fuel oils, asphalts, and special products section of California Research Corp.'s Richmond, Calif., laboratory. Fox joined the Richmond laboratory staff in 1953. **Donald G. Fuqua** has joined the Richmond staff as research engineer, refinery technical service division. At the Cal Research La Habra, Calif., laboratory, **Loren N. Miller,** formerly with Fluor Corp., has joined the company as research engineer in the producing technology section.

GONZALES

PRESSLER

Dr. Richard J. Gonzales, coordinator of finance and economics for Humble Oil & Refining Co., has been elected a director. **Herman P. Pressler, Jr.,** vice president and a member of the Humble division's board of management, has been named vice president and public relations manager for the parent Humble. He will be associated with **Joseph L. Seger,** former president of the Carter division, who recently was named vice president for public affairs, including both public and governmental relations. **Dr. Charles F. Jones,** manager of the Humble division manufacturing department, has been appointed manager of the eco-

JONES

nomics and planning department for the parent Humble. He will direct economic and other studies needed for company advance planning. Succeeding Jones as manager of Humble division manufacturing will be **H. H. Meier,** assistant plant manager of the Baytown refinery. **Gordon L. Farned** will continue as Baytown refinery manager. **J. R. Barsalou,** operations manager at Baytown, will succeed Jones as assistant plant manager. Barsalou's old job will not be filled. The Humble division also announced last week that a number of groups in the division's manufacturing department will be transferred to the Baytown refinery from Houston. The changes will occur over a period of time.

Leo Schutz, assistant director of the oil and gas division in New Mexico's Office of the Commissioner of Public Lands, will retire July 1 after 27 years with the land office.

D. S. Melstrom has been named manager of styrene resin research for Shell Chemical Co. in Torrance, Calif. **M. H. Nelson,** technical assistant in Torrance, has been appointed assistant manager, operations, and assigned to styrene resin research.

J. W. Young, manager of production research for Imperial Oil Ltd., has been elected a fellow of the Chemical Institute of Canada. The honor recognizes his contributions to Canadian chemistry and chemical engineering.

John H. McCulley, general foreman of the distillation department in Humble Oil & Refining Co.'s Baytown, Tex., refinery, has been promoted to general foreman of cracking and polymerization department. McCulley has been with the company since 1939. Also at the Baytown refinery, **S. H. Mitchell, Jr.,** has been named assistant general foreman of the dock department. **Richard F. Worth** has been promoted to assistant general foreman of packaging and lube blending.

Dr. Rudolph L. Heider, assistant director of research in Monsanto Chemical Co.'s plastics division in Springfield, Mass., has been named an associate in the development department there. **Dr. Gabriel M. Grudus, Jr.,** has joined the research department in Springfield. **Ronald G. Spann** and **Robert A. Woodhead** have joined the technical services department there. **Allen C. Ludwig** and **Robert D. McCullough** have joined the manufacturing department at Monsanto's plastics division plant in Texas City.

Robert L. Kirby, production engineer with Pure Oil Co., has been transferred to Denver from Olney, Ill.

Arthur L. Vickers, assistant foreman for Sinclair Oil & Gas Co., has been transferred to Blackwell, Okla., from Garber, Okla.

Roy H. Junkins, corrosion engineer with Cities Service Oil Co., has been transferred to El Dorado, Kans., from Great Bend, Kans.

Edwin W. Pauley, Los Angeles independent, has been named chairman of the University of California board of regents.

Robert B. Capps, southern division manager in New Orleans for Kerr-McGee Oil Industries, Inc., has been named assistant chief geologist in charge of development operations in coastal and offshore areas. **Robert L. Duncan,** manager of the Canadian division since 1958, has moved to New Orleans as division manager. **J. Robert Stevenson,** district geologist in Canada, will succeed Duncan as division manager.

Ronald York, Sun Oil Co., Corpus Christi, Tex., has been elected president of the International Oil Scouts Association. York succeeds **W. J. Garrison,** of Humble Oil & Refining Co., Houston. Other new officers elected by the scouts at their meeting in Los Angeles include: **B. P. Brown,** Standard Oil Co. of Texas, Amarillo, Tex., first vice president; **Charles Keller,** The California Co., New Orleans, second vice president; **C. M. Tilley,** Standard of Texas, Albuquerque, third vice president; **Howard A. Palmer,** Honolulu Oil Corp., Midland, Tex., secretary-treasurer; and **William D. Kehoe,** Humble, New Orleans, editor-in-chief.

Wyatt L. Walker, assistant superintendent of Continental Oil Co.'s Ponca City, Okla., refinery in charge of the catalytic and thermal cracking divisions, has been named assistant superintendent in charge of the light oil and lubricating oil divisions. He succeeds **C. B. Round,** who recently was promoted to manufacturing manager of the Rocky Mountain region in Denver. **L. S. Burke,** superintendent of the Ponca City refinery's thermal cracking division, has been promoted to assistant superintendent of the refinery for catalytic and thermal cracking divisions, succeeding Walker. **Lowell H. Betow,** general foreman of the lubricating oil division, will succeed Burke as superintendent of the thermal cracking division.

▶▶▶ Personals

Paul V. Keyser, Jr. a senior vice president of Socony Mobil Oil Co., Inc., has been elected an executive vice president of the company and named president of Mobil Chemical Co., newly formed operating division of Socony. **George F. James,** a director of Socony and senior vice president in charge of finance, will succeed Keyser as senior vice president, planning and finance. Keyser has been with Socony Mobil since 1930. He has served as manager of research at Paulsboro, N. J., manager of the lubricating department, and general manager of domestic marketing. He was elected a director in 1955 and senior vice president for corporate planning last year. The new Socony operating division will carry out petrochemical activity in the U. S. and abroad (see Processing Briefs).

KEYSER

Michael E. Carr, production engineer with Cities Service Oil Co., has been transferred to Eldorado, Tex., from Odessa.

Edward V. Stine, senior geologist for Sunray Mid-Continent Oil Co., has been promoted to district geologist in Midland, Tex. **John T. Eidt,** geologist, has been named senior geologist in Tulsa.

R. A. Grady has been appointed regional manager of the production department in Columbian Carbon Co.'s Mid-Continent division, Houston. He succeeds **W. M. Greenwell,** who has retired. **R. H. Hedgecock** has been named regional manager of the land department. He succeeds **H. Scott Thompson,** who recently was promoted to Mid-Continent division general manager for Columbian.

Joe H. Miller, chief process engineer in DX Sunray Oil Co.'s Tulsa refinery, has been named manager of process and control engineering for Suntide Refining Co. in Corpus Christi, Tex. Both companies are Sunray Mid-Continent Oil Co. subsidiaries. **T. R. Barnhart,** project coordination engineer in DX's Sunray's manufacturing department, will succeed Miller at the Tulsa refinery. Miller has been with the company and its predecessors since 1951. Barnhart joined DX Sunray in 1957.

Personals

A. Subramani, assistant works manager in Assam Oil Co.'s Digboi, India, refinery, has been promoted to works manager. He succeeds **J. H. Purdie,** who has retired. **Sardar H. S. Sawhney,** senior chemist in the refinery, has succeeded Subramani. Subramani, who had been assistant works manager since 1955, is the first Indian to become works manager. He has been with the company and its affiliates since 1938. Sawhney joined the company in 1946 as a process chemist.

SUBRAMANI

R. W. Moore, chemist with Socony Mobil Oil Co., Inc., has retired after 37 years with the company.

Hobart D. Ferguson, petroleum engineer for Sunray Mid-Continent Oil Co. in Newhall, Calif., has been promoted to Los Angeles district petroleum engineer. **Richard D. Cypher,** engineer in Los Angeles, has been named staff engineer in Newhall. **Leland B. Cecil,** junior engineer in Newhall, has been transferred to Los Angeles as engineer.

C. J. G. Leesemann, acting manager of chemical marketing operations for Humble Oil & Refining Co.'s Humble division, has been named manager of the new western division of Humble's Enjay Chemical Co. division.

Clarence W. Rice, executive vice president of Colonial Oil Products Co., Des Moines, marketing subsidiary of American Petrofina, Inc., will retire June 30. Rice was sales vice president of El Dorado Refining Co. before the company was purchased by Petrofina in 1958.

Malcolm Tudor has been transferred from Durango, Colo., to the Liberal, Kans., district office of Humble Oil & Refining Co.'s Carter division as district production foreman. He succeeds **Coleman Sorrels,** who has been transferred to Great Bend, Kans.

William P. Hetzel, geologist with Cities Service Oil Co., has been transferred to Liberal, Kans., from Midland, Tex.

Kent T. Kimball, Tulsa consultant, has been elected president of Oklahoma Well Information Service, Inc., new Tulsa organization which offers a log library of full-scale electric logs to companies on a membership basis. Other officers are **Edward Haddad,** Graybol Oil Corp., vice president; **J. Craig Cartmill,** Anchor Petroleum Co., treasurer; and **J. W. Vincent,** Keener Oil Co., secretary. Schlumberger Well Surveying Corp. donated 50,000 logs as a nucleus for the library.

Edmund Field, senior research associate at the Whiting, Ind., laboratories of Standard Oil Co. (Ind.), has been named chairman of the Catalysis Club of Chicago. **Herman E. Ries, Jr.,** Indiana Standard research associate at Whiting, has been elected a member of the club's executive committee.

R. C. Sikes has been named coordinator of products supply and transportation for DX Sunray Oil Co.

Calvin Spivey has been named area manager in Australia for Petty Geophysical Co.

Thomas P. Muse, process engineer for Arkansas Louisiana Chemical Corp. in Shreveport, La., has been transferred to Magnolia, Ark., as plant engineer for the company.

Leon Landauer, area manager in charge of Norfolk, Va.,-tidewater marketing operations of Pure Oil Co., has been named marketing consultant in the Norfolk-tidewater area, a new position. **Dallas W. Manning,** manager in Pure's Richmond, Va., marketing area, will succeed Landauer in Norfolk. Landauer was president of Colonial Oil Co., Norfolk, before its purchase by Pure in 1956. Manning was district manager for Colonial in Norfolk.

Robert P. McCulloch, president of McCulloch Oil Exploration Co. of California, Inc., has been named president and chairman of Cuban American Oil Co. McCulloch became principal stockholder in the company after purchase of 809,067 shares from **Herbert W. Klein, Grady H. Vaughn, Jr.,** and Superior Oil Co. Klein, formerly president, and Vaughn have resigned as directors of the company. **T. F. Morrow,** Los Angeles, principal stockholder before the sale to McCulloch, will continue as a director.

T. W. Hollis, Shell Oil Co. division drilling foreman, has been transferred to Abilene, Tex., from Midland, Tex.

ENGEL

Herman A. Engel, Jr., manager of Union Texas Natural Gas Corp.'s Canadian division in Calgary, has been named coordinator of economics and evaluation. He will headquarter in Houston. **Kenneth W. Germond,** Canadian division exploration manager, will succeed Engel as manager in Calgary.

James O. Sanders, general sales manager of the northern region of Texaco Inc., has been promoted to assistant general sales manager of the domestic sales department. **George V. Nalle,** Norfolk, Va., division sales manager, will succeed Sanders in New York. **John T. Bolger, Jr.,** assistant New York division sales manager, wholesale, will succeed Nalle. **Walter J. Williamson,** assistant Norfolk division sales manager, wholesale, has been named assistant division sales manager in Norfolk.

Deaths

Thomas A. Carlton, 64, Houston independent operator, died June 14 at his home after a heart attack. Carlton was owner of T. A. Carlton Oil Well Service Co. in addition to his producing interests. He began oil operations in Shreveport, La., and moved to Houston in 1929.

Reece Kahle, 56, partner in Kahle Well Servicing, Drilling & Production Co., Cyril, Okla., died June 17 in an Oklahoma City hospital.

O. A. Larrazolo, 66, Albuquerque consulting geologist, died June 14 in an Albuquerque hospital. He had undergone major surgery a month before his death. Larrazolo's father served as governor of New Mexico from 1919 to 1921.

F. M. Cole, vice president in charge of Honolulu Oil Corp.'s western division, died June 8.

Leonard P. St. Clair, California oil-industry pioneer and former president of Union Oil Co. died June 21 in Los Angeles after a long illness. He was 89. Known as a champion of the independent oil producer, St. Clair was actively associated with Union Oil for 30 years. He headed the Independent Oil Producers Agency from 1901 until 1957 when he retired.

BANTAM'S big-rig features do more... earn more

Here's the most modern crawler mounted crane-excavator ever built—the BANTAM C-350! For capacity, performance and profit-making versatility, BANTAM has all the big-rig features that you want: the fastest work cycles, widest work range, biggest choice of equipment.

The ideal high-production pipeliners' crawler rig, BANTAM C-350 has standard 2-speed, independent travel permitting you to lift, swing and travel all at the same time. On big or small jobs, BANTAM with back hoe digs over 100′ of 5′ trench per hour. Add the optional BANTAM long-boom back hoe, and you dig to 18′10″ without "digging in" first to get that extra depth.

Crawler BANTAM goes everywhere!

BANTAM's low ground-bearing pressure (less than 3 lbs. per sq. inch with 32″ pads) and resulting high flotation let you go over *any* terrain without bogging down. And BANTAM's fast-acting, easy-operating mechanical controls are never affected by freezing, heat or moisture—completely maintenance-free.

BANTAM's advanced, rugged design outdates all others and assures you of years of trouble-free service on all kinds of jobs. It's travel-ready at all times—with no disassembly or special permits needed. You save time coming and going, as well as on the job.

Work and earn with 11 BANTAM-built attachments

BANTAM handles all your excavating and lifting chores, working with 11 fast-change attachments. In addition, more than 25 optional features let you equip your BANTAM to match your specific needs.

◀ Another popular BANTAM for pipeline operations—the carrier mounted BANTAM T-350. Husky 11-ton lifting capacity and easy, permit-free mobility make this BANTAM the mobile work leader of its size. Works and earns with all BANTAM-built attachments. Check the self-propelled BANTAM CR-350, too—one-man, one-engine operation. 4 x 4 drive optional.

Get the facts that prove BANTAM's superiority in speed and savings over any other rig in its class. Write for complete details today!

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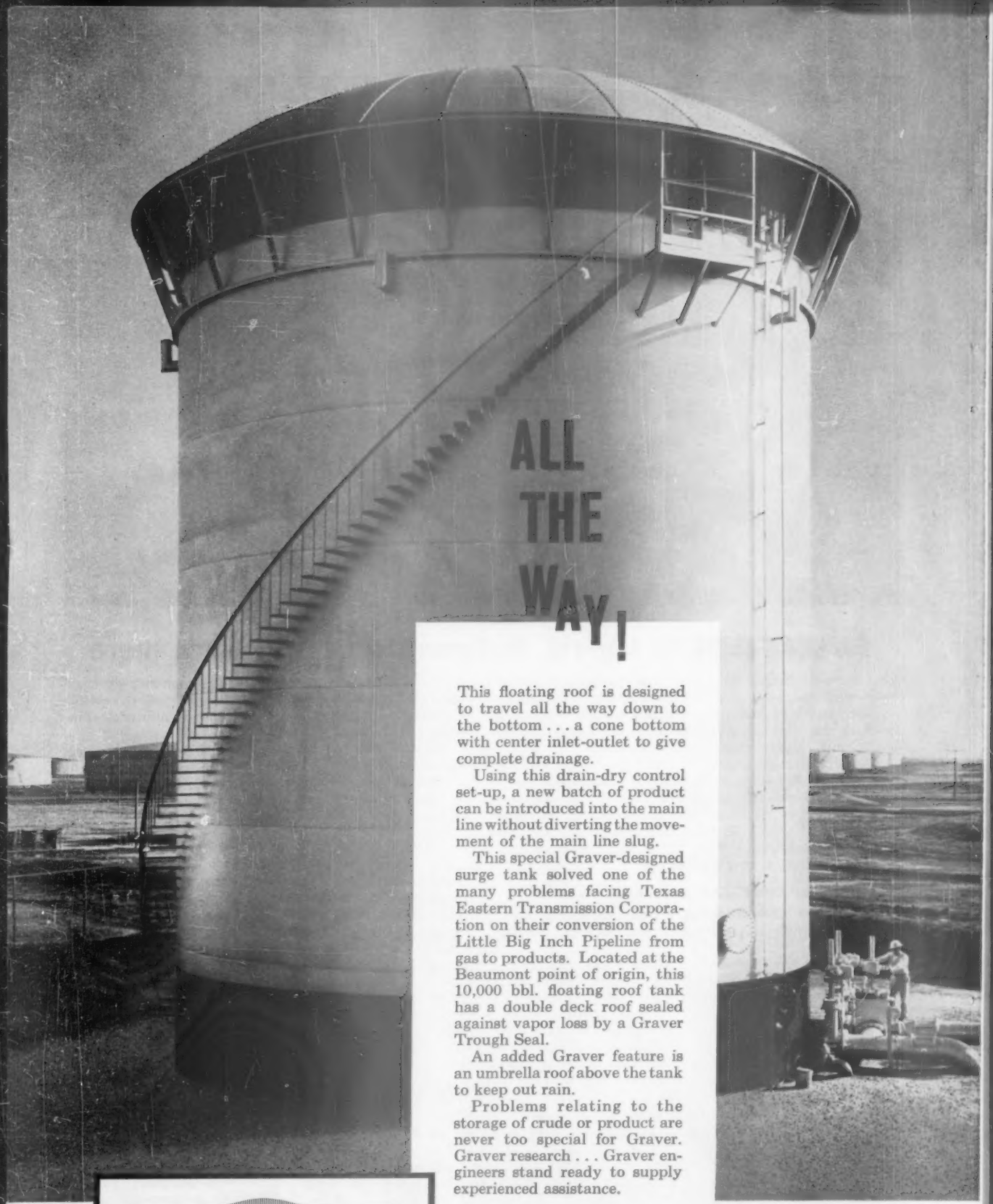
WORLD'S LARGEST PRODUCER OF TRUCK CRANE-EXCAVATORS



This floating roof is designed to travel all the way down to the bottom . . . a cone bottom with center inlet-outlet to give complete drainage.

Using this drain-dry control set-up, a new batch of product can be introduced into the main line without diverting the movement of the main line slug.

This special Graver-designed surge tank solved one of the many problems facing Texas Eastern Transmission Corporation on their conversion of the Little Big Inch Pipeline from gas to products. Located at the Beaumont point of origin, this 10,000 bbl. floating roof tank has a double deck roof sealed against vapor loss by a Graver Trough Seal.

An added Graver feature is an umbrella roof above the tank to keep out rain.

Problems relating to the storage of crude or product are never too special for Graver. Graver research . . . Graver engineers stand ready to supply experienced assistance.

Graver

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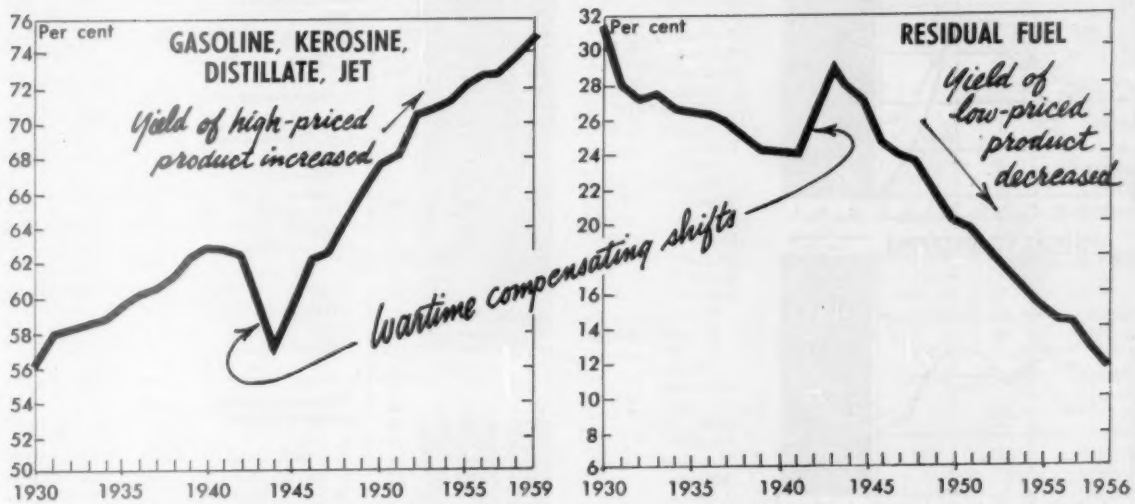
EAST CHICAGO, INDIANA

PLANTS AND OFFICES ACROSS AMERICA

Yield of Products from a Barrel of Crude


Per cent
GASOLINE, KEROSINE, DISTILLATE, JET
Yield of high-priced product increased
wartime compensating shifts
Per cent
RESIDUAL FUEL
Yield of low-priced product decreased
1930 1935 1940 1945 1950 1955 1959
1930 1935 1940 1945 1950 1955 1956

Shifts in yields bring changes for crude

BY JOHN C. CASPER

THE BIG SHIFT in refinery yields over the past 30 years has had two distinct effects on crude in this country.

1. It had tended to limit growth of crude production.

2. Increased refiner income from a barrel of products has made it possible for him to pay more for crude.

Let's take a look at the effect of yield changes on crude volume. Back in 1930, production of gasoline, kerosine, and distillate accounted for only 56.2% of a barrel of crude.

By the year 1959, demand for these products plus jet fuel had climbed to a total of 2,389,000,000 bbl. Imports supplied 44,000,000 bbl., leaving 2,345,000,000 bbl. to be produced by refiners. They met demand by running only 2,918,000,000 bbl. of crude and turning 75% of the average barrel of crude into these four important products.

If the refiner had been on the 1930 yield program of 56.2%, he would have had to process 4,173,000,000 bbl. of crude during the year. Even after deducting last year's crude imports, the domestic producer's market for crude would have been 10,400,000 bbl. daily.

But, what would the refiner have done with all of that residual fuel made from 4,170,000,000 bbl. of crude and a yield of 31.5%? Total resid production would have been 1,314,000,000 bbl. compared with last year's demand of 585,000,000 bbl. Someone would have had to find a market for an extra 729,000,000 bbl. of heavy fuel.

That surplus is equivalent to about half the production of bituminous coal in this country and 71% of the total free foreign demand for resid.

To replace other fuels and other oils in this country and abroad, the Gulf Coast price of residual would have to come down at least to $1.50 and probably to $1.00.

Realization from a barrel of crude on the Gulf Coast is about $3.68, based on current yields and current spot prices. Minor products are included at the residual price of $2.25 a barrel.

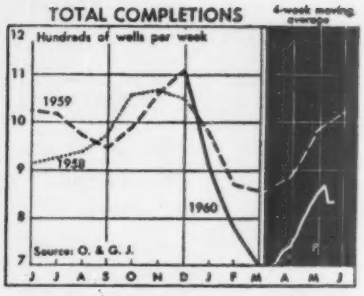
If refiners were to shift to the 1930 yield pattern, even with current prices, realization would drop to $3.43. A residual price of $1.50 would cut realization to about $3.10. If resid dropped to $1.00, realization would be down to about $2.88.

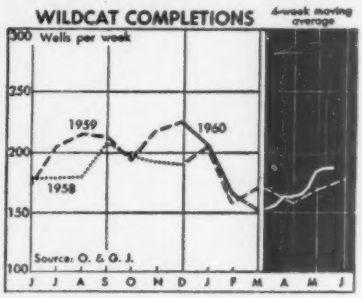
The old yield pattern would mean a bigger crude market if the refiner could sell his heavy fuel. But it also would mean a cut in average crude price to $2.00 or less.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,828,000	UP	53,000	DOWN	189,000
Crude stocks	258,903,000	DOWN	369,000	DOWN	4,261,000
Completions	847	UP	81	DOWN	153
Refinery runs	8,034,000	UP	198,000	UP	34,000
Gasoline stocks	204,372,000	DOWN	3,563,000	UP	3,748,000
Kerosine stocks	26,883,000	UP	1,095,000	UP	283,000
Distillate stocks	103,045,000	UP	1,922,000	DOWN	8,885,000
Residual stocks	39,879,000	DOWN	515,000	DOWN	14,560,000
Four-product stocks	374,179,000	DOWN	1,061,000	DOWN	19,414,000
Total imports	1,513,500	DOWN	140,900	DOWN	305,200

DRILLING





Active Rotary Rigs

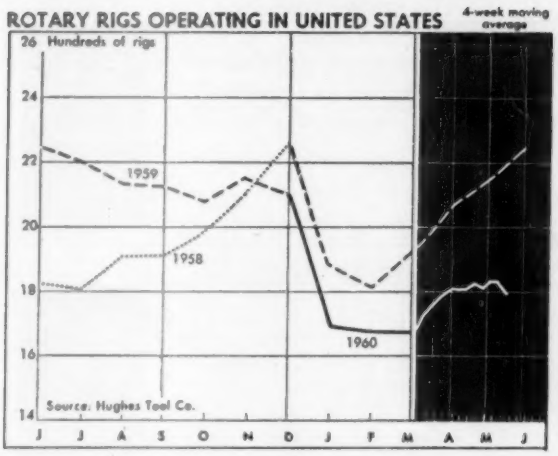
	6-20-60	6-13-60	6-22-59
Alabama	5	4	7
Alaska	4	4	(†)
Arkansas	12	13	13
Arizona	1	1	2
California	80	82	98
Land	75	76	93
Offshore	5	6	5
Colorado	25	22	42
Florida	2	2	2
Land	2	2	1
Offshore	0	0	1
Illinois	39	44	50
Indiana	7	11	5
Iowa	0	0	3
Kansas	93	109	164
Kentucky	7	8	8
Louisiana	296	291	377
North	43	44	30
S. Inland waters	107	107	156
S. Land	91	86	137
Offshore	55	54	54
Maryland	0	0	0
Michigan	47	45	26
Mississippi	58	59	71
Missouri	2	1	0
Montana	21	22	24
Nebraska	24	25	35
Nevada	0	0	1
New Mexico	124	122	121
New York	0	0	1
North Dakota	18	16	33
Ohio	7	6	4
Oklahoma	180	173	246
Oregon	0	0	0
Pennsylvania	12	14	10
South Dakota	0	0	2
Texas	602	609	791
S. Inland waters	4*	6	6
S. Land	171	176	205
Offshore	1	1	1
North	55	51	171
Panhandle	41	41	(*)
East	64	67	(*)
West Central	166	162	256
West	100	105	152
Utah	31	31	39
Washington	0	0	1
West Virginia	6	5	10
Wyoming	57	58	98
Total U. S.	1,760	1,777	2,284
Western Canada	165	156	152
Eastern Canada	2	2	0
Grand total	1,927	1,935	2,436

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. † Data first reported 4-4-60.

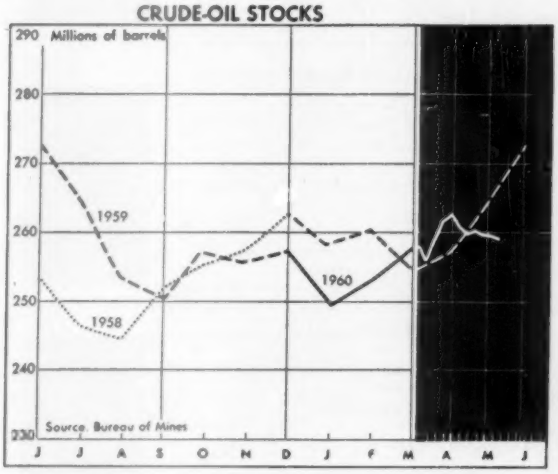
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 18, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	23	47	0	0	0	0	0	1	9
Arizona	1	0	0	0	1	0	4,015	8	.....	1	0	0	0	1	8	.....
Arkansas	10	3	0	1	6	0	32,906	281	383	1	0	0	0	1	74	62
California	73	62	0	5	6	0	437,254	668	715	6	1	0	2	3	137	169
Colorado	6	2	0	1	3	0	31,811	286	342	1	0	0	0	1	134	201
Illinois	36	15	0	0	21	0	80,702	899	964	8	0	0	0	8	208	160
Indiana	24	8	0	0	16	0	29,597	435	342	7	1	0	0	6	168	116
Kansas	61	28	0	2	30	1	225,311	1,508	1,877	16	1	0	0	15	496	416
Kentucky	18	6	0	2	10	0	25,246	743	1,059	1	0	0	0	1	87	72
Louisiana	71	28	10	2	31	0	545,374	1,558	1,658	11	0	0	0	11	230	203
North	28	10	0	1	17	0	96,169	517	598	7	0	0	0	7	101	83
South	37	15	9	1	12	0	382,968	793	880	4	0	0	0	4	113	113
Offshore	6	3	1	0	2	0	66,237	248	180	0	0	0	0	0	16	7
Michigan	22	6	0	0	12	4	69,265	350	269	6	1	0	0	5	107	62
Mississippi	10	6	1	1	2	0	119,096	342	296	2	1	0	0	1	118	136
Montana	13	6	0	0	7	0	77,351	129	135	4	0	0	0	4	58	48
Nebraska	16	5	0	0	11	0	80,299	370	373	9	1	0	0	8	144	165
New Mexico	40	25	0	4	11	0	183,475	851	861	6	1	0	0	5	120	98
West	10	5	0	4	1	0	35,421	272	382	2	1	0	0	1	24	29
East	30	20	0	0	10	0	148,054	579	479	4	0	0	0	4	96	69
New York	7	0	0	3	4	0	15,808	151	110	4	0	0	1	3	11	13
North Dakota	7	3	0	0	4	0	50,420	142	234	2	0	0	0	2	32	48
Ohio	17	7	0	4	6	0	38,061	456	451	2	0	0	0	2	26	12
Oklahoma	48	25	3	5	15	0	255,000	1,791	2,715	12	3	0	0	9	353	415
Pennsylvania	0	0	0	0	0	0	0	246	261	0	0	0	0	0	7	4
South Dakota	0	0	0	0	0	0	0	15	.....	0	0	0	0	0	6	.....
Texas	298	139	14	19	118	8	1,253,657	7,429	8,900	67	2	1	2	62	1,491	1,655
Dist. 1	30	6	1	1	22	0	88,001	513	535	20	0	0	0	20	189	150
Dist. 2	17	3	3	1	10	0	115,535	360	371	6	0	1	0	5	87	102
Dist. 3	31	13	4	2	12	0	225,192	577	530	7	0	0	1	6	107	112
Dist. 4	12	2	1	2	7	0	37,850	510	610	4	0	0	0	4	150	153
East	24	15	4	0	5	0	100,710	575	515	5	0	0	0	5	120	111
Dist. 7-B	52	28	0	1	22	1	148,225	1,088	1,246	10	0	0	0	10	304	330
West	69	47	0	1	16	5	340,954	1,969	2,771	10	1	0	1	8	307	343
Dist. 9	32	16	0	0	15	1	79,308	1,369	1,691	5	1	0	0	4	198	301
Dist. 10	31	9	1	11	9	1	117,882	468	631	0	0	0	0	0	29	53
Utah	1	1	0	0	0	0	5,845	128	165	0	0	0	0	0	44	45
West Virginia	34	3	0	23	6	2	88,262	356	334	0	0	0	0	0	4	9
Wyoming	27	9	0	0	18	0	150,442	457	399	13	0	0	0	13	198	133
Misc. (Ore., Tenn.)	7	2	0	0	5	0	12,143	52	44	5	0	0	0	5	46	28
Total U. S.	847	389	28	72	343	15	3,811,340	19,674	22,934	184	12	1	5	166	4,308	4,279
Previous week	766	383	21	35	316	11	3,387,90.	.....	.....	177	14	1	2	160	.....	.....
Cum. 1960	19,674	9,296	623	1,572	7,637	546	86,377,786	.....	.....	4,308	390	47	141	3,730	.....	.....
Cum. 1959	22,934	11,666	579	1,661	8,422	606	95,423,107	.....	.....	4,279	426	61	130	3,662	.....	.....
Western Canada	24	16	0	2	6	0	118,566	958	1,134	7	2	0	0	5	279	367

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	6-11-60	6-4-60	6-13-59
Pennsylvania	2,118	2,148	2,474
Other Appalachian	1,744	1,801	2,032
Illinois, Indiana, Michigan	10,272	10,142	9,977
Nebraska and North Dakota	2,556	2,845	2,664
Kansas	9,616	9,607	10,245
Oklahoma	18,211	17,739	16,773
Arkansas	1,873	1,957	1,777
Louisiana	19,346	20,440	18,261
North	3,452	3,466	3,226
South	15,894	16,974	15,035
Mississippi, Alabama, Florida	2,181	2,059	2,301
New Mexico	8,049	8,046	8,149
Texas	108,737	108,273	115,988
East Texas	8,558	8,523	9,745
West Texas	49,991	48,965	54,481
Texas Gulf	19,061	19,068	18,848
Other Texas	31,127	31,717	32,914
Wyoming	18,119	17,944	16,431
Other Rocky Mountain	10,388	10,290	8,936
California	28,877	29,292	32,144
Foreign	†16,816	16,689	15,012
Total	**258,903**	259,272	263,164

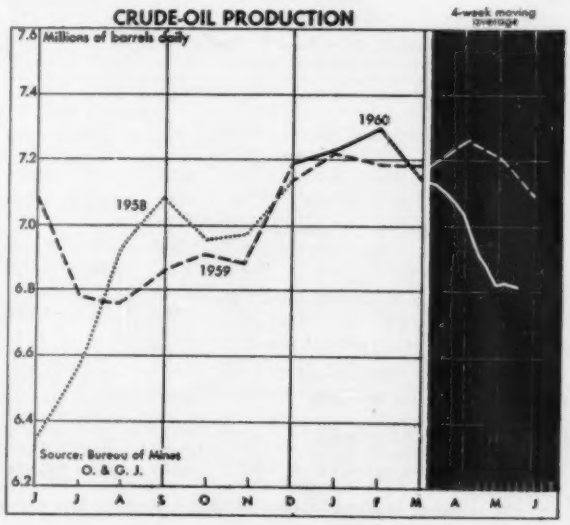
*Bureau of Mines. †Includes 4,389,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	June 18, 1960 Crude oil	Lease condensate	Total	June 11 total
Alabama	18,100	.....	18,100	18,000
Arkansas	77,100	100	77,200	77,175
California	834,100	.....	834,100	832,000
Colorado	128,000	.....	128,000	129,000
Eastern	40,100	.....	40,100	39,900
Florida	1,000	.....	1,000	1,000
Illinois	209,800	.....	209,800	209,700
Indiana	31,400	.....	31,400	31,500
Kansas	†282,710	.....	†282,710	†267,900
Kentucky	63,100	.....	63,100	61,100
Louisiana	924,900	126,300	1,051,200	1,050,725
North	107,900	5,800	113,700	113,225
South	817,000	120,500	937,500	937,500
Michigan	40,500	.....	40,500	40,500
Mississippi	136,750	.....	136,750	136,300
Montana	75,000	.....	75,000	76,000
Nebraska	62,000	.....	62,000	59,800
Nevada	100	.....	100	100
New Mexico	288,500	.....	288,500	288,500
North Dakota	59,500	.....	59,500	59,000
Oklahoma	†525,300	.....	†525,300	†486,200
Texas	2,374,000	87,900	2,461,900	2,461,900
Dist. 1	42,000	3,000	45,000	45,000
Dist. 2	100,000	8,200	108,200	108,200
Dist. 3	314,000	37,000	351,000	351,000
Dist. 4	163,000	18,000	181,000	181,000
Dist. 5	26,000	350	26,350	26,350
Dist. 6	102,000	9,000	111,000	111,000
East Texas field	123,000	.....	123,000	123,000
Dist. 7-B	126,000	150	126,150	126,150
Dist. 7-C	117,000	2,825	119,825	119,825
Dist. 8	958,000	6,500	964,500	964,500
Dist. 9	196,000	1,900	197,900	197,900
Dist. 10	107,000	975	107,975	107,975
Utah	105,000	.....	105,000	108,500
Wyoming	335,000	.....	335,000	338,900
Others	‡1,240	.....	‡1,240	‡1,150
Total U. S.	6,613,200	214,300	**6,827,500**	6,774,850
Change from previous week, up			**52,650**	
Canada	†566,400	.....	†566,400	†493,100
Total U. S. prod.—Jan. 1-June 18				1,200,163,900 bbl.
Same period last year (crude plus cond.)				*1,217,402,200 bbl.

*Includes 32,346,300 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

CRUDE-OIL PRODUCTION



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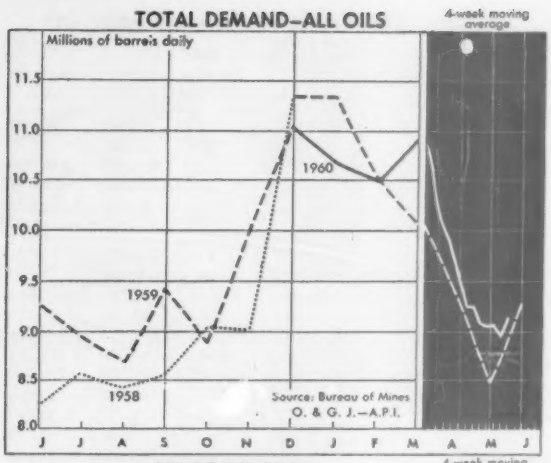

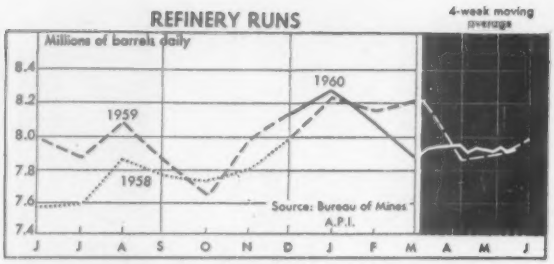

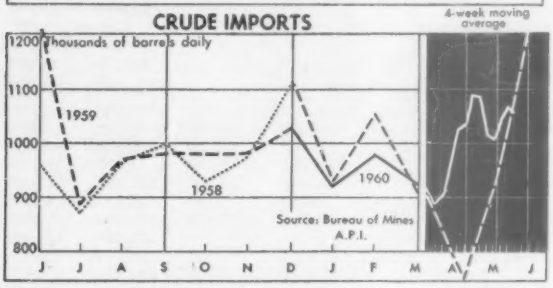

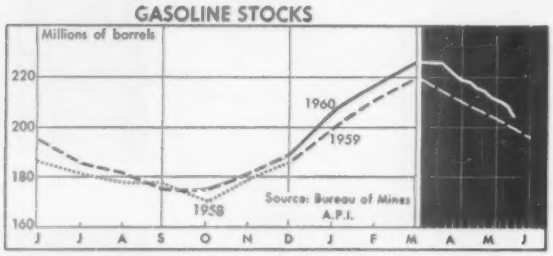

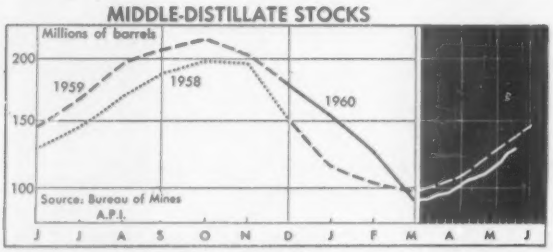

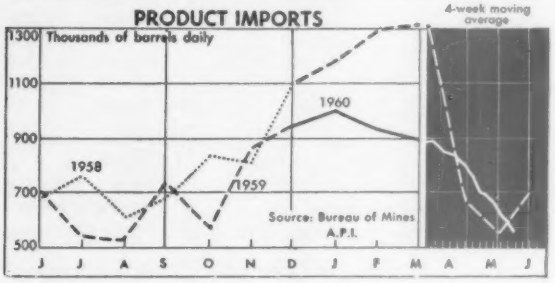

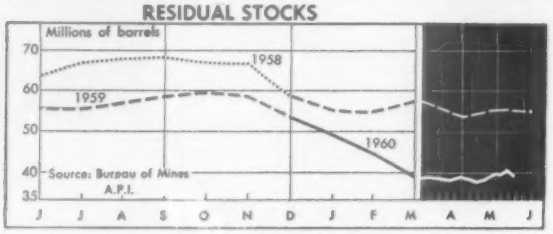

API REFINERY REPORT—JUNE 17, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1959—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,102	529.6	48.0	318.1	139.2	47,007	10,421	36,187	10,929	1,067	490.5	19.6	281.2	171.5
Appalachian:														
District 1	92	39.9	3.1	20.9	7.6	6,234	590	2,334	378	104	45.3	3.2	22.6	6.8
District 2	82	43.0	5.0	17.3	6.3	2,790	312	984	287	110	52.0	5.1	22.9	8.2
Ind., Ill., Ky.	1,444	814.8	64.7	301.8	162.5	36,847	5,247	18,002	4,592	1,497	777.9	62.7	302.4	147.9
Minn., Wis., Dak.	130	62.4	2.0	35.1	17.7	6,858	903	4,278	667	114	53.4	5.7	29.2	14.3
Okla., Kans., Mo.	727	415.9	14.9	174.8	17.1	12,963	1,232	8,888	1,011	759	417.3	12.8	179.0	23.7
Inland Texas	318	238.1	10.3	50.4	22.6	6,863	550	1,517	2,426	292	226.0	8.5	51.6	19.5
Tex. Gulf Coast	1,957	967.7	124.1	449.3	128.3	23,912	3,260	10,121	4,065	1,788	965.4	72.5	449.4	149.5
La. Gulf Coast	601	300.3	43.3	134.9	36.6	10,778	1,726	4,555	1,314	720	396.6	41.1	190.0	50.3
N. La. and Ark.	107	60.0	8.7	21.9	4.3	5,110	615	2,187	142	94	44.4	5.0	21.3	6.5
Rky Mountain:														
New Mexico	29	17.6	1.0	5.4	2.6	825	42	177	18	24	12.3	0.1	4.6	2.6
Other Rocky Mt.	272	137.1	2.7	59.3	31.6	6,630	236	2,073	923	304	131.3	3.7	62.8	29.4
West Coast	1,173	585.3	52.1	200.9	291.7	31,555	1,747	11,742	13,127	1,117	516.9	3.8	174.6	284.7
June 17, 1960	8,034	4,211.7	379.9	1,790.1	868.1	204,372	26,883	103,045	39,879	7,990	4,129.3	243.8	1,791.6	914.9
June 10, 1960	7,836	4,134.1	372.1	1,777.6	821.3	207,935	25,788	101,123	40,394	.....	.....	.....	.....	.....
June 19, 1959	8,000	4,083.4	266.3	1,818.7	901.4	200,624	26,600	111,930	54,439	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.70
- Middle District 4.52
- Southwest Pennsylvania ... 4.25
- West Virginia 4.07
- Buckeye Grade 4.07

Illinois Basin **2.85-3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):
- Arabian, about 34°, Ras Tanura $1.90
- Iranian, 34.0°-34.9°, Bandar Masur 1.86
- Iranian, 34.0°-34.9°, Abadan 1.81
- Iraq, 36.0°-36.9°, Fao 1.82
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.67
- Qatar, about 41°, Um Said. 2.05

Middle East, E. Mediterranean:
- Arabian, about 35°, Sidon.. 2.29
- Iraq, about 35°, Tripoli, Banias (Grade A) 2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 37° 2.57

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)
- ★ Gulf-NY, clean (ATRS—30.0%) $2.00
- ★ Carib.-NY, dirty (ATRS—50.0%) 1.38
- PG-Japan, dirty (USMC—75.0%) 2.55
- PG-UK, dirty (Scale—67.5%) (21s. 10d.). 3.05

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. 11.50
- Premium (99 octane). 14.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 10.25-10.50
- Regular (92 octane) .. 10.50-10.75
- Premium (98 octane) .. 11.50-11.75

California (rack) Los Angeles:
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane). 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) .. 10.00
- Premium (97 octane) .. 11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.00-9.25
- Diesel oil (58 d.i. and above) 8.75-9.00
- Distillate No. 1 ..... 8.75-9.00
- Distillate No. 2 ..... 7.75-8.00

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.00
- Distillate No. 2 ..... 8.00

New York Harbor (barges):
- Kerosine 41-43 ..... 10.05
- Distillate No. 2 ..... 9.05
- Diesel fuel, 48-52 d.i. 9.35

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- ★ Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.10-2.25

New York Harbor (barges):
- Bunker C fuel $2.47

Caribbean (cargoes):
- Bunker C $2.10

California (rack):
- Bunker C fuel, Los Angeles $2.15

★Denotes change from previous week.

CLASSIFIED ADVERTISING

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WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona) Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287.

FOR SALE EQUIPMENT

350 EMSCO Rotary Drilling Rig, hydromatic brake, powered by 2 Twin 6-71 GMC diesel engines, 800 H.P., 7¼ x 14 Gardner Denver mud pump compounded, 129' Lee C. Moore derrick, 7' substructure, 7500' 4½" Grade E drill pipe hard banded, 2—7 x 12' steel dog houses, everything complete, now working, fastest rig out; ALSO, 300 Emsco Rotary Drilling Rig, hydromatic brake, powered by 2—1879 Buda engines, 378 H.P., 7¼ x 12 Gardner Denver mud pump compounded, 127' Lee C. Moore derrick, 6' substructure, 6000' 4½" drill pipe, 2—7 x 12' dog houses, everything complete, now working, will Sell or Trade one or both, Make Offer. Box L-886, The Oil and Gas Journal, Tulsa, Oklahoma.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/8"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.

INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527

NEW CROLOY 5 HEATER TUBES

Priced at ½ New Cost

Must Move at Once

14—3¼" x ⅜" wall x 44' long
63—4" x ⅜" wall x 26' long
10—4" x ⅜" wall x 32' long
50—4" x ½" wall x 32' long
3—5" x ½" wall x 42' long
42—6" x ½" wall x 27' to 47' long

HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

FOR SALE EQUIPMENT

WELL DRILLS, core drills. Everything for well and core drilling. New and used equipment at money saving prices. Everything in supplies. Nationwide sales. Send for bulletins—Pressey & Son, Pueblo, Colorado.

FOR SALE—complete trailer camp consisting of seven trailers and light plant with complete facilities for sleeping and feeding twenty-one persons, which includes all bedding, dishes, cooking utensils, etc. Camp now located at the Trading Post, Round Rock, Arizona, approximately sixty miles North of Window Rock Arizona. Contact Cowden, Cities Service Oil Company, Bartlesville, Oklahoma.

LIQUIDATION

AMOCO REF. DESTREHAN, LA.

BOILERS, 70,000 #/hr. & 80,000 #/hr. 450 Psi.
HORTONSPHERES, 5,000 & 10,000 bbl.
EXCHANGERS, 78 to 2,800 sq. ft.
TOWERS, 3 ft. to 7½ ft. diameter.
VESSELS, 2 ft. to 10 ft. diameter.
FURNACES, 26 MM BTU/hr.
TURBO EXHAUSTERS, 15,360 & 17,000 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 290 HP.
TANKS, 1,000 to 29,000 bbl.
COMPRESSORS, (IR) XVG—4 & XVG—2.

BRILL EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
35-53 JABEZ ST. NEWARK, N. J.
4101 SAN JACINTO, HOUSTON, TEXAS

FOR SALE EQUIPMENT

WHEATLEY PIPE-LINE pump—Model WBL-141, duplex reciprocating, 6—7" x 10" side pot valves, skid-mounted; with 100 Hp. electric motor, 3/60/440V, v-belts, sheaves and etc; Complete. One Fractionating Tower —4' x 65', 50 psi. with 25 Trays. Welded. Two Stripper Towers—One 30" x 27' welded; One 24" x 16' welded. Both with bubble trays; Bargains. Kinslow Equipment Company, P. O. Box 5283, Tulsa, Oklahoma. WE 9-6896.

BAILEY BRIDGES

Portable Prefabricated
BAILEY BRIDGE
RENTALS & EQUIPMENT
P. O. Box 753,
San Luis Obispo, Calif.

LIQUIDATION

at ESSO REFINERY Balto., Md.

TOWERS

10' x 145'—125 PSI 50 trays
9'6" x 121'—325 PSI 30 trays
8'6" x 103'—165 PSI 24 trays
7'0" x 82'— 75 PSI 30 trays
6'0" x 80'—300 PSI 30 trays
4'0" x 44'—150 PSI 12 trays
3'6" x 36'—400 PSI 12 trays
2'6" x 52'—360 PSI 22 trays
2'2" x 57'— 85 PSI 4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube ..... 7,500 to 100 sq. ft.
Adm. Tube ..... 3,500 to 236 sq. ft.
Cu Ni Tube ..... 2,330 to 308 sq. ft.
S. S. Tube ..... 1,000 to 170 sq. ft.

BLOWERS—11,880 CFM @ 11 PSIG
INSTRUMENTS—Controllers, Recorders, Indicating and Transmitting
MOTORS—10 HP to 500 HP XP
PIPE CHROME—3¾" to 14" OD
PUMPS—Hot Oil, Steam, Centrifugal
REACTOR—8' x 32'6" OA
REBOILERS—2,700 to 450 sq. ft.
TRANSFORMERS—5 KVA to 333 KVA
VALVES—Diaphragm, Butterfly Slide and Pressure Regulating
VESSELS PRESSURE—3' to 12' Dia.

PETRO CHEM FURNACE
1.9 MILLION BTU NEW 1949

WRITE FOR COMPLETE CATALOG

HEAT & POWER CO. INC.
60 East 42nd St., New York 17, N.Y.
310 Thompson Bldg., Tulsa 3, Okla.
Box 5203, Baltimore 24, Maryland

NEW IDECO RIGS AND MACHINERY

RECONDITIONED AND USED MACHINERY

USED RIGS

FOR RENT: USED IDECO 133' Full View Drilling Mast on 8' high x 46-10" long Substructure. Attractive Rate.
FOR LEASE: USED BREWSTER N-4 Rig Complete. Gas-Butane Power. 93' Lee C. Moore Mast. 5600' of 4" O.D. Drill Pipe.
FOR SALE: USED WAUKESHA 6LRZ Engine with Fawick Clutch mounted on Extended Skid with V-Belt Sheave and Roller Bearing Pillow Blocks.
FOR SALE: USED IDECO H-35 Hydrair Torque Converter Draw Works with 2—Waukesha 6WAK Gas-Butane Engines.
FOR SALE: Two USED BOWEN 7⅜" O.D. Double Bowl Overshots.
FOR SALE: 3,250' USED 4½" Grade E Drill Pipe with [illegible] O.D. Tool Joints. Inspected, Tested and Graded for Unlimited Service.
FOR SALE: 7,000' NEW 4½" Grade E Drill Pipe. 10% Discount.

LUCEY

LUCEY PRODUCTS CORPORATION
624 So. Cheyenne Tulsa 19, Oklahoma
Phone: LUther 4-4711
Oklahoma City—Woodward, Oklahoma • Dallas—Odessa, Texas

ANOTHER LARGE AUCTION

PIPE INCORPORATED

Highway 44 West
Corpus Christi, Texas

Thursday, July 14, 1960
10:00 A.M. (CST)

PIPE PIPE PIPE PIPE PIPE

Pipe Inc. is Closing its Corpus Christi yard, and has commissioned Wayne Cook Associates to sell the entire inventory of pipe as well as trucks, trailers and other equipment at public auction. There are thousands and thousands of feet of good pipe, no junk, to be sold in lots to suit the buyers.
Everything will be sold to the highest bidder without minimum or reservation.

31000'—2⅛" O.D., 4.70#, J55, 8rd. thrd., EUE, R2 used S.S. tubing, some tested to 3000#.
52075'—2⅞" O.D. tubing including 8rd.; 10rd.; 10V, and 11½ V threads, most of which is 6.40# and 6.50#, J55, EUE, R2. Some tested to 5000#, some to 3000#.
665'—3½" O.D.; 9.20#, J55, 10rd.; non-upset, R2, S. S. tubing
160'—4½", 10.79# new line pipe, P. E. Bev.
1265'—4½"—11# used casing, C. W.
3000'—4½" 11# new galv. casing C. W.
1000'—4½" 11#, 8V thrd., new galv. line pipe
1135'—4½" 15#, 8V used S. S. pipe, R2
1775'—5" O.D., 15#, J55, 10V, ST&C, R2 used S. S. casing
2080'—5½" O.D., 15.50#, J55, 8rd., ST&C, R3 used S. S. casing
785'—5½" O.D., 15.50#, J55, LT&C, R2, used S. S. casing
3700' of 5½" O.D., 14#, J55, 8rd., ST&C, R2, used S. S. casing
4000'—5½" O.D., 15.50#, J55, 8rd., ST&C, R2, used S. S. casing
780'—5½", 17#, J55, 10V, ST&C, R-2, used casing
700'—5½", 23#, P-110, X line, R3, used casing
3580'—6⅝", 12.89#, PE, Bev., Drl., used EW line pipe
2360'—6⅝", 14.97#, PE, Bev., Drl., used EW line pipe
2540'—6⅝", 18.97#, P. E. Bev., SRL used LW line pipe
795'—7" O.D. 26#, J55, 8rd, ST&C, R2, used casing
1005'—7⅝", 26.40#, J55, 8rd., ST&C used casing
110'—8⅝", 28#, H-40, 8rd., ST&C, R2 used casing
125'—9⅝", 47#, N80, 8rd., LT&C., R3, used casing
2765'—10¾", 40.50#, 8V, ST&C, R3 used LW casing
260'—10¾" 40.50#, 8V, ST&C, R1, used LW casing
150'—10¾", 40.50# P. E. Bev., used LW line pipe
63'—12¾" P. E., Bev. used line pipe
655'—16", 42.05#, P.E. Bev, used LW Line pipe
280'—20", P. E. used line pipe
100'—24" P. E. used line pipe
60'—30"—½" wall, 157.54#, P. E. Bev. line pipe

NOTE

The following pipe is located at Southwest Barge Terminal Yard in Lake Charles, Louisiana. There are representative samples of the pipe in the Corpus Christi yard and it will be sold in Corpus Christi on sale day. Pipe in Lake Charles may be inspected anytime prior to sale day.

2394'—5", 15#, J55, 8rd., ST&T R3, S. S. casing
395'—5½", 14#, J55, 8rd, ST&T, R2, S. S. casing
3670'—5½", 15.50#, J55, 8rd, ST&T, R3 casing
7910'—7", 26#, J55, 8rd, ST&C, R2 & R3 casing

All above listed pipe has had threads and collars cleaned and doped, rust banded and thread protectors installed on pin end.

Other inventory and equipment includes:

2400' of ½" x 25' pin and pin new sucker rods
40780'—⅝" x 25' pin and pin used sucker rods
3,350'—¾" x 25' pin and pin used sucker rods w/paraffin scrapers.
12,500—⅞" x 25' pin and pin used sucker rods.
350'—⅞" x 25' pin and pin used sucker rods w/slim hole boxes
Assorted used couplings
2—Trucks, 2 Trailers, air compressors, welder, stuffing boxes, emulsion treator, office furniture, beveling machines, piperacks, hand tools, pipe cleaning machine, pipe straightener, bradon heads and other items too numerous to mention.

For Brochure with complete Listing Contact Auctioneers:

Wayne Cook Associates, Inc.
"The Nation's Leading Auctioneers"
193 Meadows Bldg., Dallas 6, Texas
EM 3-3358

COMPLETE PIPELINE CONSTRUCTION SPREAD
From 30" Down to Smaller Diameter Pipe

Catepillar Tractors (2U and 3T); 320 Cleveland Ditchers; Insley Backhoes; Insley Draglines; Littleford 25-Barrel Dope Pots; C-R-C Bending Machine; M. J. Crose Boring Machine; Ingersoll-Rand Air Compressors; Ample Miscellaneous items to complete a spread of equipment.
Equipment purchased new—most at the same time. Has not worked 50% of time—has laid less than 1,000 miles of pipe. Equipment in good working condition—always been well maintained.
You are invited to inspect equipment. Detailed list of spread with serial numbers furnished on request.

EASTERN PIPELINE CONTRACTORS
820 Mercantile Bank Building, Dallas, Texas

STAFF ENGINEER: Large, independent, integrated oil company with home office in Southwest has opening Natural Gasoline Dept. Must have had a minimum of 3 years experience in design and operation of natural gasoline plants and facilities. Graduate engineer with major in chemical, petroleum or refining. Submit complete resume. Box L-879, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: All or part interest Cable Tool Drilling Company 36L Bycyrus-Erie, 32S Walker-Neer; skid mounted complete with 4", 5½", 7" tools. Steel dog houses. Good condition. Ready to work. Rhoades Drilling Co., Hays, Kansas.

FOR SALE: Small gas treater for hydrogen sulphide removal. Unit recently shut down and in good operating condition. Box L-885, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL WELL skid mounted gas compressor, Model DGE-250, Single stage unit. Equipped with 4¼" x 13" cylinders, Happy VIR-68 Cooler, Climax Model V-122 engine, complete with "safety" accessories. Apply: Box L-888, The Oil and Gas Journal, Tulsa, Oklahoma.

1—LATE MODEL NKRBU Waukesha with skids and power take off. 1—WAK Waukesha reconditioned with skids and power take off. 1—Twin Disc Model F Torque Converter. All priced reasonable. Claypool Drilling Company, St. Elmo, Illinois, Phone: TAylor 9-3232.

FOR SALE

200,000 Ft. of 3½" O.D. Seamless A-1 Used Locomotive Tubes, Clean Inside and Out. Roller-Beveled Ends. 18' and over in lengths.

Wire, Write, or Phone

COLUMBUS STEEL SUPPLY
1000 BONHAM AVE. • AX 4-4461
COLUMBUS, OHIO

EQUIPMENT WANTED

FAILING 2500, Joy 300, or Franks 35 Drilling Rig. With or without accessories. Forward complete details first letter. Must be priced right for quick sale. Box L-871, The Oil and Gas Journal, Tulsa, Oklahoma.

WE ARE interested in the purchase of your depleted wells for salvage. Also, used casing, tubing, units, tanks, etc. Must be in Kansas area. The Buckeye Supply Company of Kansas, Inc., 105 S. Main, El Dorado, Kansas.

127 FT. Lee C. Moore Jackknife Derrick. 7' or 8' Substructure for 3 engine compound. Box L-891, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT WANTED

SONOLOG, ECHOMETER, or Acoustic Well Sounder. Box 1388, Wichita Falls, Texas.

HELP WANTED

MAYHEW MODEL 2000 on I.H.C. Tandem. 48' mast. 5 x 8 pump and booster, 2—⅞ x 20 drill pipe. Extra truck and trailer. Complete—now drilling. Write for Inventory. Box L-878, The Oil and Gas Journal, Tulsa, Oklahoma.

1—4½ x 6 Gardner Denver pump. 1—5 x 8 Gardner Denver pump. 1400'—2⅞ x 20 Mayhew drill pipe—good condition. 1—56' Sectional Mast for Joy 200. Box L-877, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER

Graduate chemical engineer with from 1 to 3 years refinery process engineering, preferably including some refinery economics and computer experience. Assignment will be in newly organized computer section.

Send resume of education, experience and salary requirements to:
Personnel Manager
National Cooperative Refinery Ass'n.
McPherson, Kansas

PROCESS ENGINEERS

Re-Evaluate Your Position

If you are a Graduate Chemical Engineer with 3 to 10 years experience in one or more of the following: Gas Plants, Gas Plant Design, Gas Treating, Sulfur Plants and General Refinery Process Design.

Furthermore, if you are interested in associating with a company that stresses diversification and you are interested in making a change to the West Coast, airmail your resume to:

Technical Personnel

PARSONS

617 West 7th St.

Los Angeles 17, Calif.

HELP WANTED

SALESMAN for line of automated chemicals and maintenance detergents for the oil and gas industry. Sales training. Position open about July 25. Write Chemicals, P. O. Box 341, Dallas 21, Tex.

EXPERIENCED REFINERY instrument man, or helper, familiar with Foxboro pneumatic and large case electronics. For work in modern integrated refinery. Salary $2.72 per hour, plus time and one-half and double time. Send resume of experience to Personnel Director, Delta Refining Company, P. O. Box 3097, Memphis, Tennessee.

GEOLOGIST TO take charge of exploration for small but aggressive company operating chiefly in the Anadarko Basin. Prefer independent background with good field experience. An excellent opportunity for the right man. Send complete resume including experience, transcripts and references. We will contact you in regard to an interview. Box L-868, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST—M.S. petroleum geology. 8 years experience in both subsurface geology and geophysics. Age 33, single. Locate anywhere. Resume upon request. Box L-890, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 18 years of field and supervisory experience in drilling, production and reservoir engineering. Background includes work in United States, South America, Africa and Middle East. Speaks Spanish and French. Desires responsible position with producing company operating overseas. Box L-870, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM PRODUCTION Engineer: Age 34, married. 4 years experience domestic major, 4 years production supervisor, Venezuelan major. Desires position with aggressive domestic independent or foreign. Box L-872, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST Age-26. B.S. Degree from O.U. Two years exploration experience, Mid-Continent. Excellent success ratio. Jim Mundy, Pawhuska, Okla.

GEOPHYSICIST, BS Geophysist engineer, married, 4½ years seismic and other diversified exploration experience. Desires change to smaller company or independent. Resume on request. Box L-889, The Oil and Gas Journal, Tulsa, Oklahoma.

ELECTRICAL ENGINEER 34, B.S., 7 years with Latin American Major, varied electrical, control, and construction background. Desires position, foreign or domestic, with future potential. P. O. Box 313, Ft. Collins, Colorado.

ATTORNEY, B.B.A. in Accounting, LL.B. from S.M.U., LL.M. in Federal Taxation from N.Y.U., 7½ years experience in oil and gas and federal taxation matters—4½ years major oil company—3 years private practice. Married, presently in private practice, desire change to other private practice or corporation. Box L-880, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER—Four years petroleum refinery experience, including pilot plant studies, trouble-shooting, operating supervision, some maintenance, economics and forward planning. Desires supervisory position medium sized oil or petrochemical company. Resume or request. Box L-881, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST - ENGINEER (BS) - Western Canada, Williston Basin, Oklahoma, and Texas. 4½ years experienced in all phases of geology and production. 1½ years tubingless completions. Consultant for past year. Desires responsible position with active independent. Box L-883, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCING

CAPITAL needed to drill offset production in West Virginia oil bringing 4.07 at well. Gas—.25c per thousand, in West Virginia, big play. David W. Law. Phone: HU 5-6446, 716 Union Trust Building, Parkersburg, West Virginia.

LEASE AND DRILLING BLOCKS

HAVE approved acreage in Ohio to farm out. David Law—Phone HU 5-6446, 716 Union Trust Building, Parkersburg, West Virginia.

CHEATMAN COUNTY, Tennessee: 3,000 acre block, geologic structure on producing trend, geologist has mapped surface, report available; 60 cents per acre, 3/32 override, Box 2493, Salt Lake City, Utah.

PICKETT COUNTY, Tennessee—100 acre adjoining Knox Sand production price $15.00, with 1/8 override block 720 acres price $5.50 with 1/8 override. We have drilling blocks and farmouts. Come inspect. Wire, phone Cravens & Thomas, Parkway Hotel Bldg., Burkesville, Kentucky.

ROYALTY UNDER Majors In Northeastern Ohio. 19,000 acres under Phillips, Sun, Ohio, Jet, Kewanee, Crusader in—Ashtabuia, Portage, Trumbull, Wayne Counties, Ohio. Will sell complete interest at bargain price. Drilling now on acreage. Box 3268, Erie, Pennsylvania.

3,500 ACRES $2 per acre. Lawrence County, Ky. in midst of new gas play. Ten year leases in first year, 1/8 override, no drilling committment, 50 cents per acre annual rental. U. S. Andersen, 8350 Santa Monica Blvd., LA 46.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

MICHIGAN OIL gas leases, blocks and drilling deals. Lease Broker, member Petroleum Landmens associations. Neil Wagenaar, 504 Peoples Natl. Bank Bldg., Grand Rapids, Michigan.

80 ACRE AND 90 acre leases in proven area. Need additional capital for drilling and completion. Shallow production Montgomery County, Kansas. S & M Drilling Co., Box 98, Cherryvale, Kansas.

PROVEN GAS RESERVES

Newly discovered gas field. Market nearby, suitable for storage. Interested purchasers may write for complete information. Box L-887, The Oil and Gas Journal, Tulsa, Oklahoma.

NOTICE OF PROPOSED SALE OF OIL AND GAS LEASES AND OTHER PROPERTIES BY TEXAS CONSOLIDATED OILS

This is to give notice that Texas Consolidated Oils, 35th Floor Southland Center, Dallas 1, Texas, desires to sell all of its producing and non-producing oil and gas leases in Texas, Oklahoma, New Mexico, Louisiana, Kansas and California; and other related property. Anyone interested in making a sealed bid for the purchase of these properties may obtain bidding forms and a statement of the terms and conditions relating thereto, with a schedule of property being offered for sale attached, by writing the Company at the above address. A packet containing individual lease plats, production data, and other general information will be available to prospective bidders upon deposit or One Thousand Dollars ($1,000.00). Such deposit will be returned by the Company to any party making a bid on these properties or upon return of the packet of data forty-eight (48) hours or more in advance of 10:00 A.M. Central Standard Time on July 15, 1960. Bids for the properties will be considered only if made in accordance with and subject to the terms and conditions set forth in such statement. All bids must be presented to or received by:

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Republic National Bank of Dallas, Texas
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on July 15, 1960

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EASTERN KANSAS proven Bartlesville production 740 ft. deep, 8 inside locations, 4/8 working interest for sale. $500.00 per 1/8 to drill No. 1. For details write: Box L-882, The Oil and Gas Journal, Tulsa, Oklahoma.

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THE OIL AND GAS JOURNAL
P. O. Box 1260—Tulsa 1, Okla.

ROYALTIES

HIGHEST PRICE paid for income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

NOTICE INVESTORS, income producing oil, gas-distillate royalties for sale. Ogden Oil Company. P. O. Box 490, Taylor, Texas.

WANT LISTINGS of producing royalties and non-producing royalties. Give full information. R. E. Clement, Box 65, Norman, Oklahoma.

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Phone: CEntral 5-4468

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 355.09 acres of land in two parcels, within the known geologic structure of the Clareton field, Weston County, Wyoming, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., MST, August 3, 1960, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

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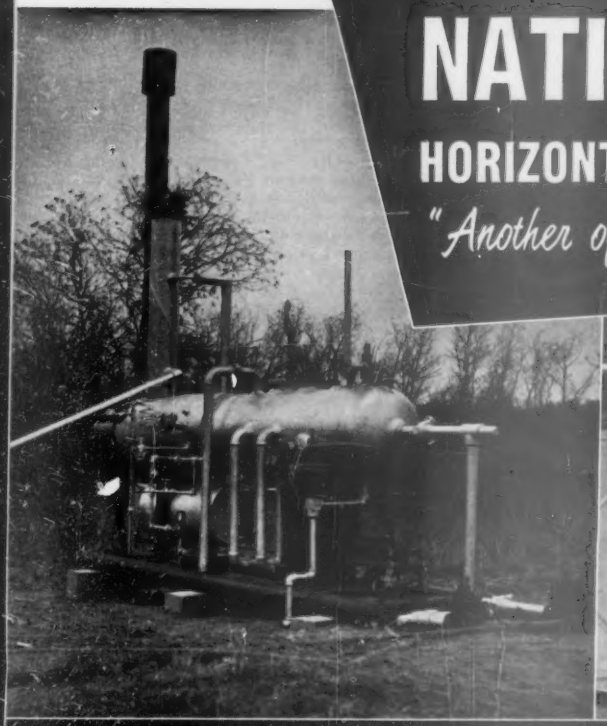
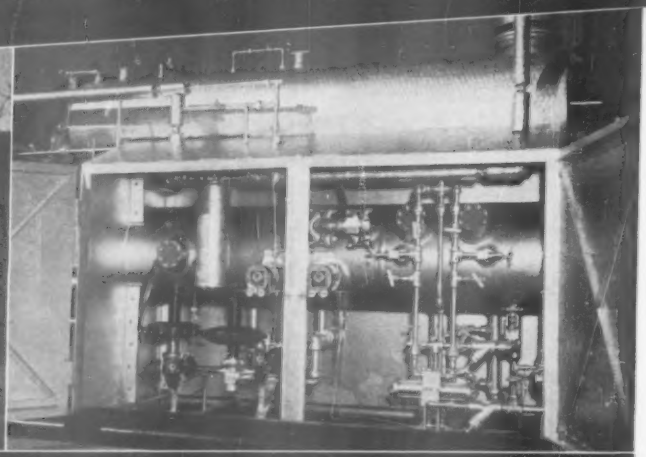


UNIT WITH INLET SCRUBBER ON STREAM NEAR OKLAHOMA CITY



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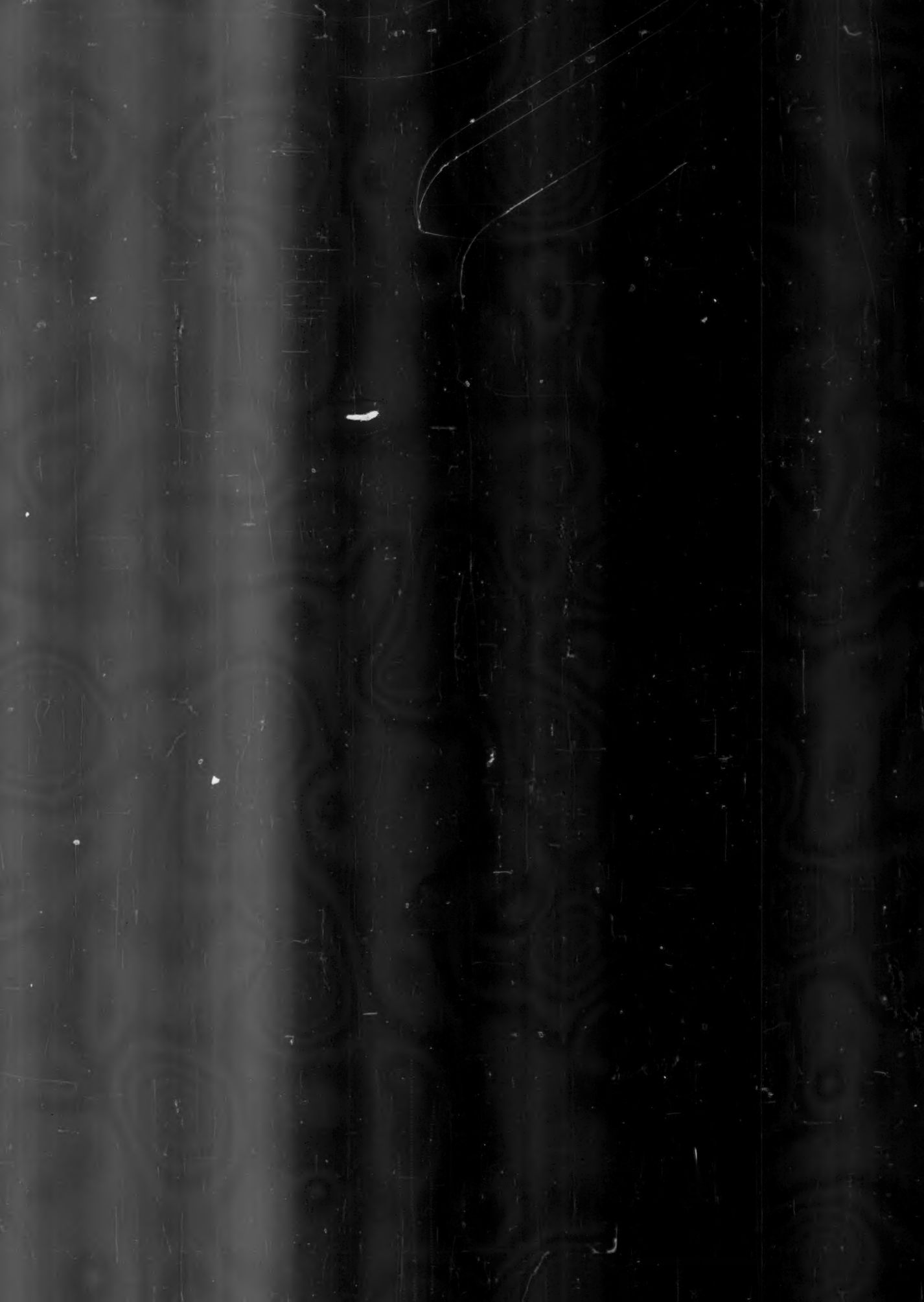
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